National Dam
Inspection Program

Phase I
Inspection Report for LEROY ANDERSON DAM

April 1981

Prepared for Department of the Army
The Corps of Engineers
Sacramento District

By State of California
The Resources Agency
Department of Water Resources
Division of Safety of Dams

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1981

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Paul Stone

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NATIONAL PROGRAM FOR INSPECTION OF DAMS

PHASE I INSPECTION REPORT
FOR
LEROY ANDERSON DAM
SANTA CLARA, CALIFORNIA

AUTHORIZATION: Preparation of this report was authorized by the National Dam Inspection Act, Public Law 92-367.

BRIEF ASSESSMENT: The report has been reviewed by this office and I concur with the assessment and directions of the Chief of the Division of Safety of Dams.

According to NPID criteria, the spillway is inadequate since information in the report reveals that the dam can pass only 80 percent of the PMF, in lieu of the 100 percent required by the guidelines, without overtopping. The increased hazard potential from overtopping and failure of such a large dam, immediately above a highly populated flood plain, could result in catastrophic consequences. It is therefore imperative that the recommended Phase II studies, consisting of detailed hydrologic and hydraulic analysis and modifications if required, be accomplished as soon as practicable.

These conclusions are based solely on information contained in the report.

APPROVAL: This report creates no liability on the United States, its officers, or employees. The owner and operator continue to be solely responsible for all legal duties, obligations, or liabilities associated with the ownership or operation of the dam.

APPROVED: ______________ DATE: 19 May 81

PAUL F. KAVANAUGH
Colonel, CE
District Engineer

NATIONAL DAM INSPECTION PROGRAM
PHASE I REPORT
LEROY ANDERSON DAM
SANTA CLARA COUNTY

BRIEF ASSESSMENT

The Phase I investigation of Leroy Anderson Dam has been completed. The conclusions of the investigation are that:

> The foundation is adequate, and the dam is stable for all assumed loading conditions including a seismic coefficient of 0.2g.
>
> Rapid convergence of the spillway channel below the weir section produces unstable flow conditions.
>
> The spillway is inadequate. The PMF will overtop the embankment dam up to a maximum of 2½ feet.
>
> The outlet works are in good operating condition and are adequate.
>
> General surveillance of the dam is adequate; however, additional information is needed to interpret the piezometer data.

The recommendations of this report are that:

> Necessary information for interpretation of the piezometer readings should be obtained. This information was requested from the owner by the Division of Safety of Dams (DSOD) in a letter dated November 5, 1980.
>
> A recent study by DSOD indicated that the spillway is inadequate to pass the PMF. By letter dated January 15, 1981, the DSOD directed the owner to make a detailed hydrologic and hydraulic analysis of the performance of the dam under PMF conditions, and indicated alterations to the structure or modifications in the operation of the dam and reservoir may be required.

ENGINEERING CERTIFICATION

This report has been prepared under my direction as the professional engineer in direct responsible charge of the work, in accordance with the provisions of the Professional Engineers' Act of the State of California.

JJ Doody

James J. Doody, Chief
Division of Safety of Dams
Registered C. E. No. 6500

Date:

State of California
The Resources Agency
DEPARTMENT OF WATER RECOURCES
Division of Safety of Dams

NATIONAL DAM INSPECTION PROGRAM
PHASE I REPORT

Dam	Leroy Anderson
State	California
County	Santa Clara
Stream	Coyote Creek
Tributary to	San Francisco Bay
Owner	Santa Clara Valley Water Distict
Location	Sec. 1, T.9S., R.3E., MDB&M

Report prepared under the direction of	James J. Doody Division Chief RCE 6500
Under the Supervision of	Donald J. Finlayson Supervising Engineer RCE 8706
and	Robert F. Fingado Senior Engineer RCE 8853
by	G. H. Swanson Associate Engineer RCE 16397

Geology prepared under the supervision of	Wilferd W. Peak Supervising Engineering Geologist CEG 1
by	Guy L. Hanegan Senior Engineering Geologist CEG 189

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NATIONAL DAM INSPECTION PROGRAM
PHASE I REPORT
LEROY ANDERSON DAM

1. INTRODUCTION

1.1 Authority

This evaluation is made under the authority of the National Dam Inspection Act, Public Law 92-367, August 8, 1972, and a contract executed between the United States of America (represented by the Sacramento District, United States Army Corps of Engineers) and the State of California (represented by the Department of Water Resources).

1.2 Purpose

The purpose of the Phase I investigation is to identify dams which may pose hazards to human life or property and to recommend additional investigations when required.

1.3 Scope

The Phase I investigation is primarily a review of records and a systematic visual inspection which form the basis for an assessment of the condition and safety of the dam and appurtenances. Records considered include, where available, the plans and specifications under which the dam was built; exploration, testing and design reports leading to that design; evaluations; and the studies and reports made by and in the files of the State of California, Department of Water Resources, Division of Safety of Dams (DSOD).

2. DESCRIPTION OF PROJECT

2.1 Data Summary

a. General

Name	Leroy Anderson Dam
Owner	Santa Clara Valley Water District
Stream	Coyote Creek
Location	11 miles southeast of San Jose
Drainage area	194 square miles
Constructed	Started 1949-completed 1950
Mean annual precipitation	20 inches
Probable Maximum Flood peak inflow	60,224 cubic-feet per second (cfs)
Probable Maximum Storm	72 hour duration, 24.01 inches rainfall; 19.21 inches rainfall excess

b. Reservoir

	Pool Elev.* (feet)	Surface Area (acres)	Storage Capacity (ac.-ft.)
Streambed	431	--	--
Minimum pool	431	--	--
Spillway (S/W) crest	625	990	91,300
Crest of dam	640	1,060	111,400
Probable Maximum Flood (PMF)	642.5	1,100	115,000

*U.S.C. & G.S. Datum

c. Dam

Type	Earth and rock
Elevation-crest of dam	640.0 feet
Freeboard-S/W crest to crest of dam	15 feet
Freeboard above probable maximum flood pool	Dam overtops by 2.5 feet
Height, lowest point in foundation to crest of dam	252 feet
Height, downstream toe to crest of dam	About 235 feet
Side slopes:	
Upstream	2½ Horizontal (H):1 Vertical (V)
Downstream	2½H:1V
Length of crest	1,380 feet
Width of crest	40 feet

d. Dikes	None

e. Spillway

Type	Ungated ogee crest and concrete chute
Location	Right abutment
Crest elevation	625 feet
Crest length	191.2 feet
Spillway length	About 860 feet
Stilling basin	None
Discharge capacity at PMF pool	57,442 cfs
Discharge capacity at crest of dam	42,200 cfs

f. Outlet Works

Type	Single continuous conduit
Location	Beneath midsection of dam embankment
Elevation of inlets	431 feet
Inlet valves	Single hydraulically operated 42-inch slide gate
Outlet system	Single 49 1/8- inch I.D. steel conduit encased in 18 inches of reinforced concrete
Downstream valves	Single 42-inch butterfly
Discharge capacity	500 cfs
Water surface at Elevation	625 feet

g. Hydroelectric None

2.2 General Description

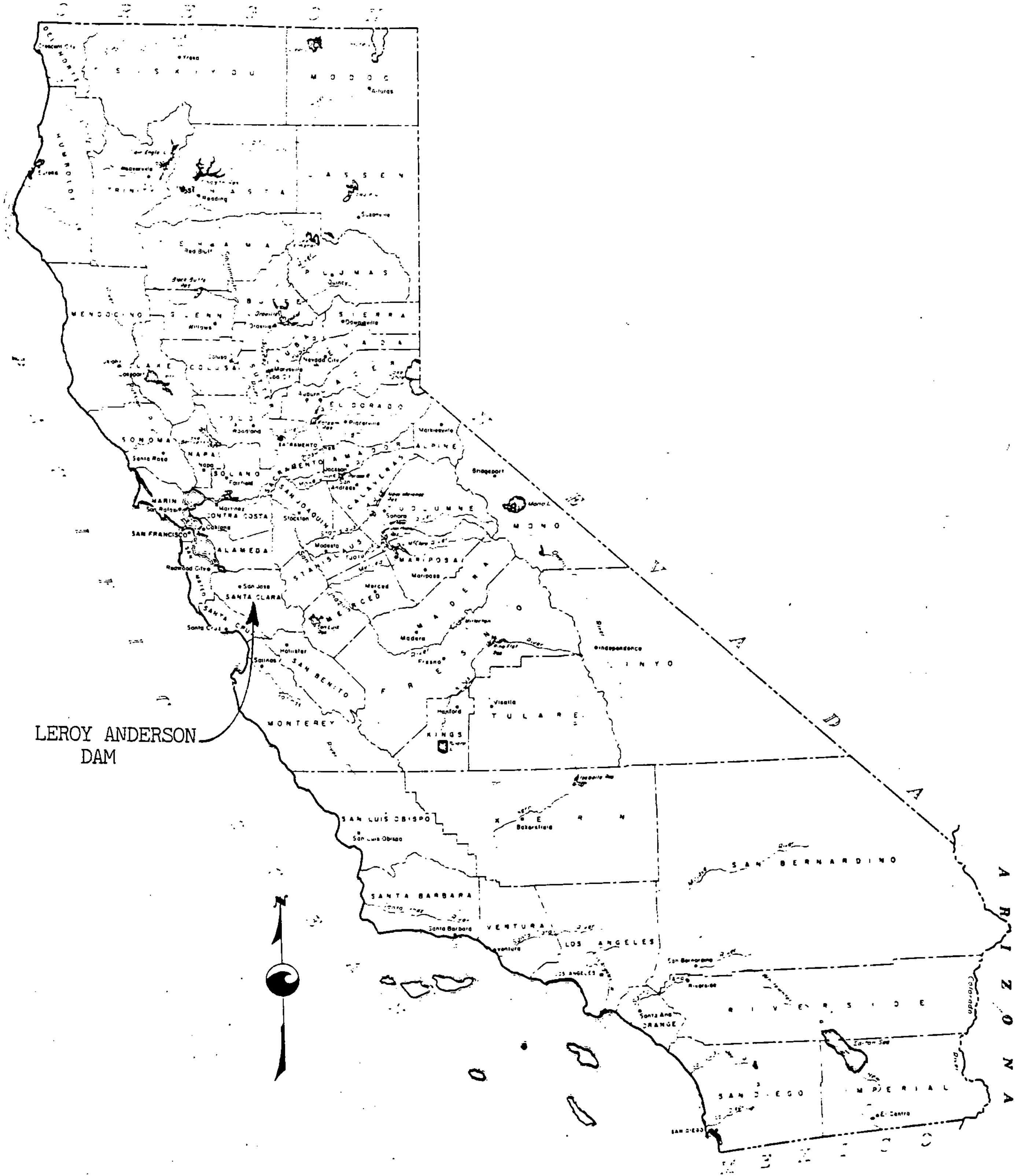
Leroy Anderson Dam is located in Santa Clara County about three miles north of Morgan Hill or 11 miles southeast of San Jose. It is located on Coyote Creek which is tributary to San Francisco Bay. The dam is in Section 10, Township 9S, Range 3E, (MDB&M). The location is shown on Plates 2-1 and 2-2.

The dam and reservoir are owned and operated by the Santa Clara Valley Water District. The name and address of the General Manager are:

Mr. John T. O'Halloran, General Manager
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

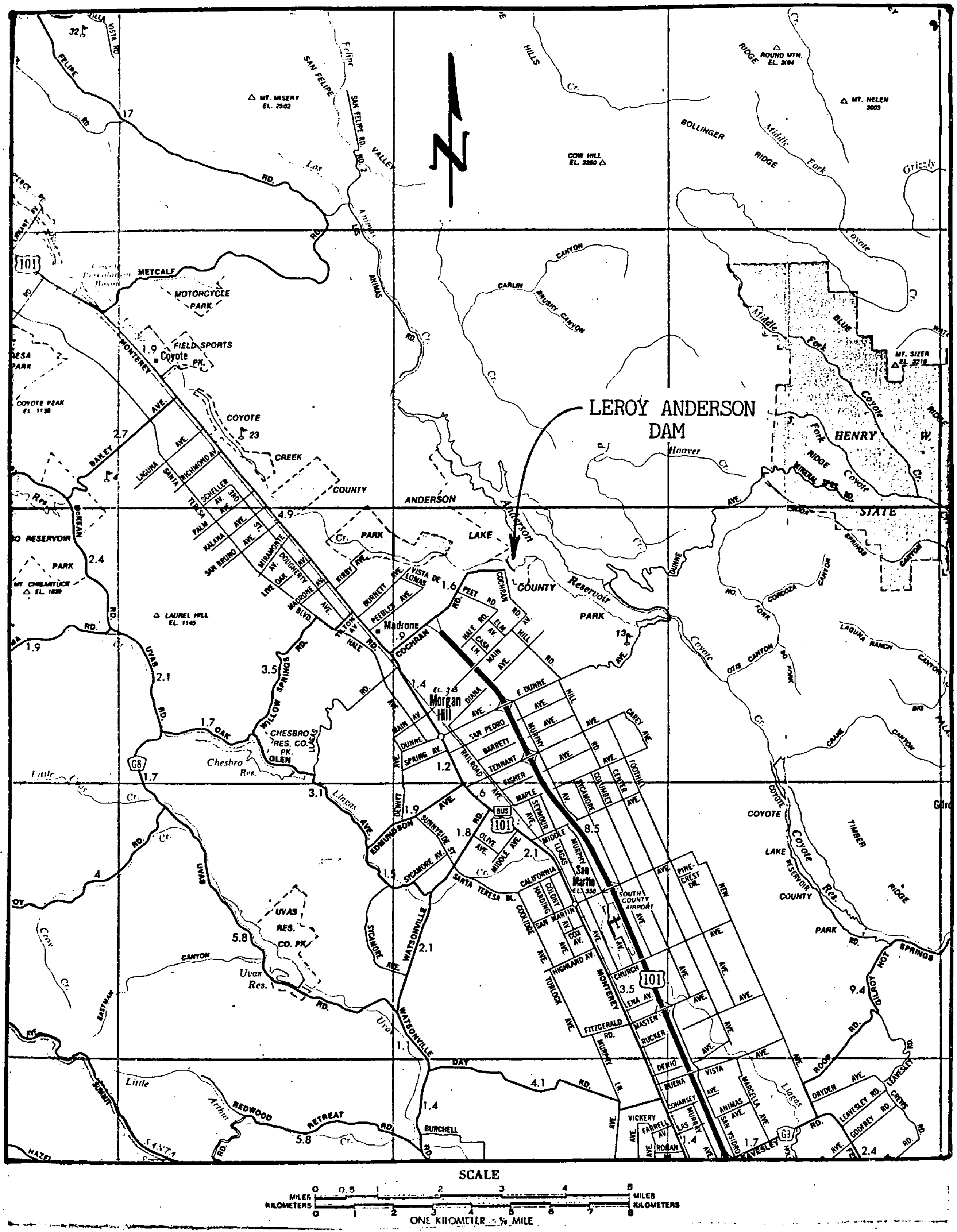
Telephone: (408) 265-2600

The storage is used for groundwater recharging the irrigation supply. Recreational use of the reservoir includes boating and fishing.



LOCATION MAP

Plate 2-1



VICINITY MAP

Basic Map Reproduced by Permission of California State Automobile Association, Copyright Owner

2.3 Size Classification

Leroy Anderson Dam is 235 feet high. The reservoir contains 91,300 acre-feet of storage when full. Since the height is greater than 100 feet and the storage exceeds 50,000 acre-feet, the size classification is "Large" according to the National Dam Inspection Program criteria contained in "Recommended Guidelines for Safety Inspection of Dams", (Reference 1).

2.4 Hazard Classification

The area along Coyote Creek downstream from the dam contains numerous residences, some of which are immediately below the dam. A boys ranch exists one mile downstream from the dam. If failure of Leroy Anderson Dam occurred, flooding would extend through the towns of Morgan Hill and Madrone which are about three miles distant.

If the dam failed the potential for loss of life would be more than a few, and economic losses to residential, business and agricultural property would be high. The hazard classification is "High" according to the National Dam Inspection Program criteria, (Reference 1).

2.5 Dam

Leroy Anderson Dam is a zoned earth and rock embankment. It is 235 feet high as measured from the downstream toe to the dam crest, and contains 3,250,000 cubic-yards of material. Exterior slopes are $2\frac{1}{2}$ horizontal to 1 vertical for both the upstream and downstream shells. The central impervious core has a 20-foot width at the dam crest with slopes upstream and downstream of $\frac{3}{4}$ horizontal to 1 vertical. The crest length is approximately 1,380 feet. Freeboard between the spillway crest and dam crest is 15 feet. Construction started in 1949 and was completed in 1950. The dam is shown on sheets 1 and 4 of the selected drawings in Appendix A.

2.6 Spillway

The spillway is located on the right abutment ridge. The control is a concrete ogee section having a crest length of 191.2 feet at Elevation 625. Downstream of the weir is an 860-foot long reinforced concrete lined channel. The concrete channel terminates at Elevation 535. Spillway flows continue in an unlined channel approximately 900 feet before entering Coyote Creek below the dam. The spillway is shown on sheets 2 and 3 of the selected drawings in Appendix A.

Flow characteristics of the spillway are discussed in Section 5.3.

2.7 Outlet Works

The outlet works consist of a single 1,160 foot long, 49 1/8-inch I.D. steel pipe, having a wall thickness of 5/16 inch, in an 18-inch-thick reinforced concrete encasement. It passes beneath the center section of the embankment. Discharge is into a 150-foot-long reinforced concrete channel. The invert elevations are 430.9 upstream and 404.6 downstream. Details of the outlet are shown on sheets 4 and 5 of the selected drawings in Appendix A.

The upstream control is a 42-inch slide gate with hand operated hydraulic controls. The hydraulic controls are housed on the dam crest and are shown in Photo No. 4-11.

The hydraulic lines between the controls and the valve are two 1-inch double extra strong galvanized iron pipes encased in a box of 2-inch redwood boards which is anchored at 10- foot centers on the upstream face of the dam.

The owner reports that the time required to fully open or close the upstream slide gate is approximately three hours.

The outlet inlet is protected by a reinforced concrete structure with trashracks consisting of ½-inch by 5-inch steel bars spaced at 6 inches across the openings. In 1960 this inlet structure was extended vertically 8 feet, 8 inches. The present inlet structure is shown on Photo No. 2.1.

The downstream outlet control is a single 42-inch butterfly valve located within a vault approximately 100 feet downstream of the toe of the dam embankment. It is operated either electrically or manually.

A 16-inch line (the District's Main Avenue Turnout) is tapped into the outlet conduit a short distance upstream from the 42-inch butterfly valve. District personnel reported the capacity of this turnout to be 15cfs.

2.8 Reservoir

Leroy Anderson Reservoir is relatively long and narrow. It is approximately 7 miles long and generally is about ¼ mile wide. The storage capacity is 91,300 acre-feet at its maximum normal water surface of Elevation 625 feet, the level of the spillway crest.

There are numerous landslides located around the perimeter of the reservoir. In the event of a strong seismic event in conjunction with saturated conditions, there is a potential for widespread sliding in the area. The landslides around the reservoir are discussed in more detail in Section 3.4, Reservoir Slope Stability.

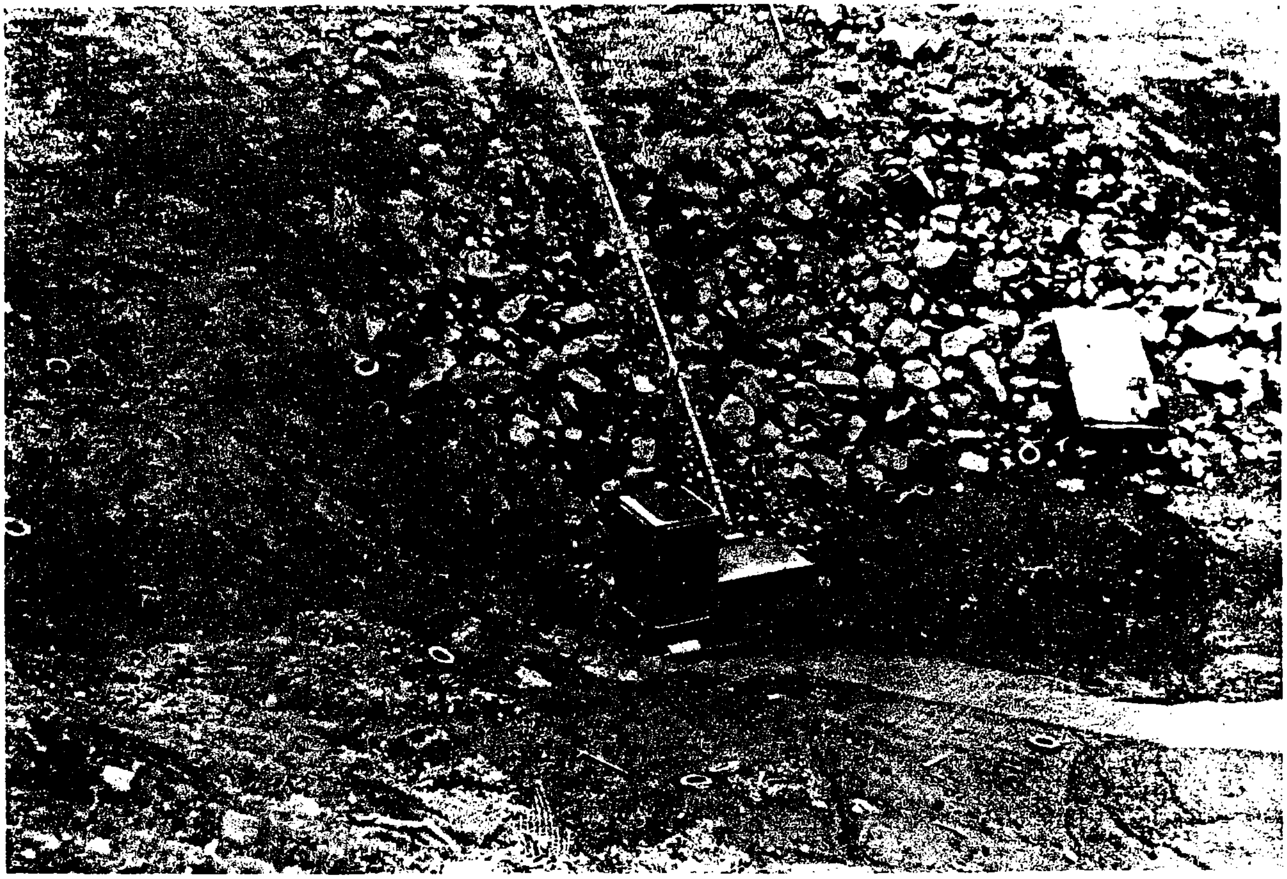


Photo No. 2.1
The outlet inlet structure as extended in 1960.

2.9 Watershed

The total area of the contributing watershed for Leroy Anderson Reservoir is 194.3 square miles. Of this, 74.5 square miles runs off directly to the reservoir. Coyote Dam and Reservoir impair the remaining 119.8 square miles. The terrain is mountainous varying in elevation from 625 to 3414. The cover is grass with large areas of sparse trees with brush. There has not been any development in the watershed which would alter the natural runoff characteristics.

An outline of the watershed is shown on Plate 2-3.

2.10 Operational Procedures

Leroy Anderson Dam and Reservoir are operated to provide groundwater recharge and for irrigation. Storage is obtained by natural runoff. There is no importation of water to the reservoir. Releases are made for irrigation demands and to three separate groundwater recharge facilities.

There are no requirements for flood control in the operation of the dam and reservoir.

The Certificate of Approval issued by DSOD on May 4, 1966, authorizes impoundment to Elevation 625.00, U. S. C. & G. S. Datum, the spillway crest.

2.11 Emergency Warning Procedures

The Santa Clara Valley Water District has a written plan for evacuation of persons residing within the area of expected inundation in case of impending failure of Leroy Anderson Dam. The evacuation plan is divided into three sectors: Gilroy, Morgan Hill, and San Jose. The plans for Gilroy and Morgan Hill are included in Appendix B. The evacuation plan for the third sector is to be determined by the City of San Jose. It is not available for inclusion in this report.

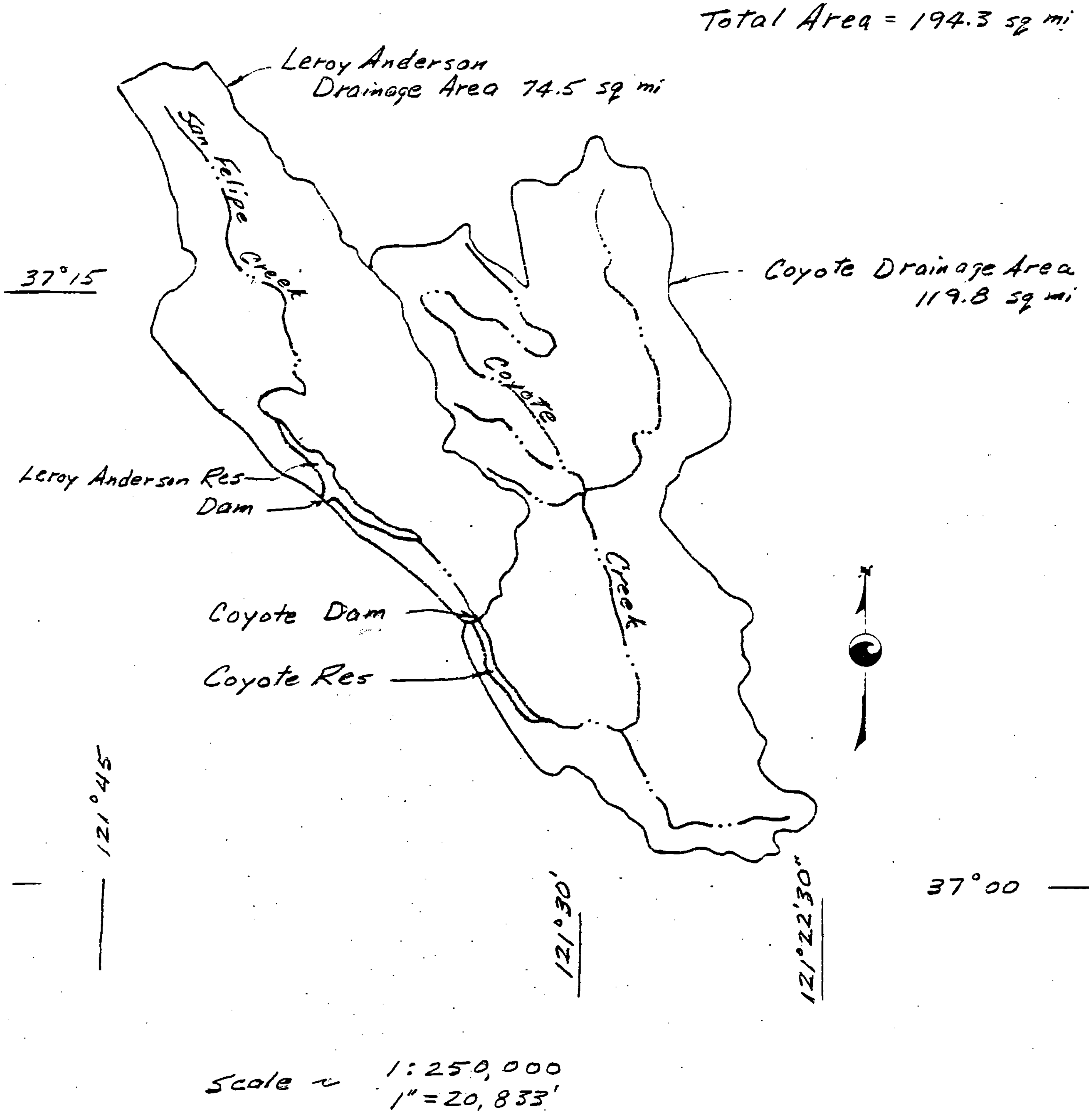

Total Area = 194.3 sq mi
Leroy Anderson Drainage Area 74.5 sq mi
San Felipe Creek
Coyote Drainage Area 119.8 sq mi
37°15
Coyote
Creek
Leroy Anderson Res
Dam
Coyote Dam
Coyote Res
121°45
121°30'
121°22'30"
37°00
Scale ~ 1:250,000
1" = 20,833'

PLATE 2-3

3. GEOLOGY

3.1 Regional Geology

The dam is in the Coast Ranges structural and geomorphic province. The central core of the ranges consists of Jurassic-Cretaceous Franciscan formation flanked by Cretaceous and Tertiary sedimentary formations. Intrusive and extrusive igneous rocks are found locally. Late Tertiary to Pleistocene deposits cover portions of the older rocks in the foothills.

Regional structural deformation consists of northwest trending folds and faults. The Calaveras fault runs through the reservoir, and several associated faults, the Silver Creek and Coyote Creek faults, run near and under the dam. The San Andreas fault lies 21 kilometres (13 miles) west.

Landslides are common in the younger sediments.

Regional Geology is shown on Plate 3-1, Page 3-3.

3.2 Site Geology

Most of the dam foundation consists of Franciscan sandstone and shale. Serpentines and greenstones are exposed largely upstream from the dam. The intake structure foundation may be serpentine, and the right abutment foundation above Elevation 540 is serpentine.

The Plio-Pleistocene Santa Clara formation underlies most of the reservoir area.

The geologic structure is extremely complex in the Franciscan formation. The younger Santa Clara strata, however, have been folded into a series of northwest trending anticlines and synclines. Near the dam these latter beds generally dip to the southwest.

The Calaveras Fault, about 1.6 km (one mile) northeast of the dam, is the dominant local geologic feature. The fault zone is almost 0.8 km (0.5 mile) wide here, and the southeast end of the reservoir lies in the fault valley.

The Coyote Creek fault can be traced about 12 km (7 miles) northwest from the dam, and it merges with the Calaveras Fault from 5 km (3 miles) to 11 km (7 miles) southeast of the dam. The fault splits into five branches near the dam, and two of these branches can be projected under the dam embankment. Sedimentary rock in the dam foundation is separated from the serpentine by one branch of this fault.

The Coyote Creek fault dips from 40° to 65° northeasterly. The northeast side has moved upward relative to the southwest side. The sense of motion is reversed, right lateral.

Local geology is shown on Plate 3-2, page 3-5.

3.3 Foundation Conditions

The foundation geology is complex and the foundation conditions vary widely. Most of the foundation is Franciscan sandstone and shale with some greenstone and serpentine. Sediments are generally fresh and firm, closely fractured, and may contain local concentrations of gypsum seams. Serpentines are soft and sheared.

The outlet pipe is in a trench on the lower left abutment. The trench foundation varies from hard massive sandstone to soft, wet, black shale. It includes decomposed igneous rock, serpentinized sediments, and several fault zones consisting of crushed rock, mostly upstream of the dam centerline.

A zone of crushed serpentine from 6 to 20 feet wide trends across the channel and lower right abutment. Some years after completion of the dam, this zone was determined to be a branch of the Coyote Creek fault (Reference 3). The channel foundation downstream of this fault is hard, fractured, gray sandstone. Several small springs in the foundation required sealing before the embankment could be placed.

Much of the lower right abutment foundation is dense shale with some massive sandstone. The upper 100 feet of this abutment foundation is serpentine of very poor quality. It becomes soft when saturated, and concern was expressed for its stability during construction.

Terrace gravels were removed from the lower left abutment, leaving a foundation of dense, hard rock (volcanic?) and hard, dark gray shale. Weathered volcanics on the upper left abutment were judged unsatisfactory, and the axis was shifted 255 feet upstream to avoid these weak materials. This allowed for a foundation of tight shales and volcanics with "blue clay" or gouge above Elevation 465.

About ten years after completion of the dam, a slide developed high on the left abutment. The boat ramp was damaged, but the intake structure below it was not. Geologic mapping and field investigations have shown that it virtually impossible for debris from any known landslide to plug the intake. (Memorandum by Guy L. Hanegan, November 13, 1979, Appendix E).

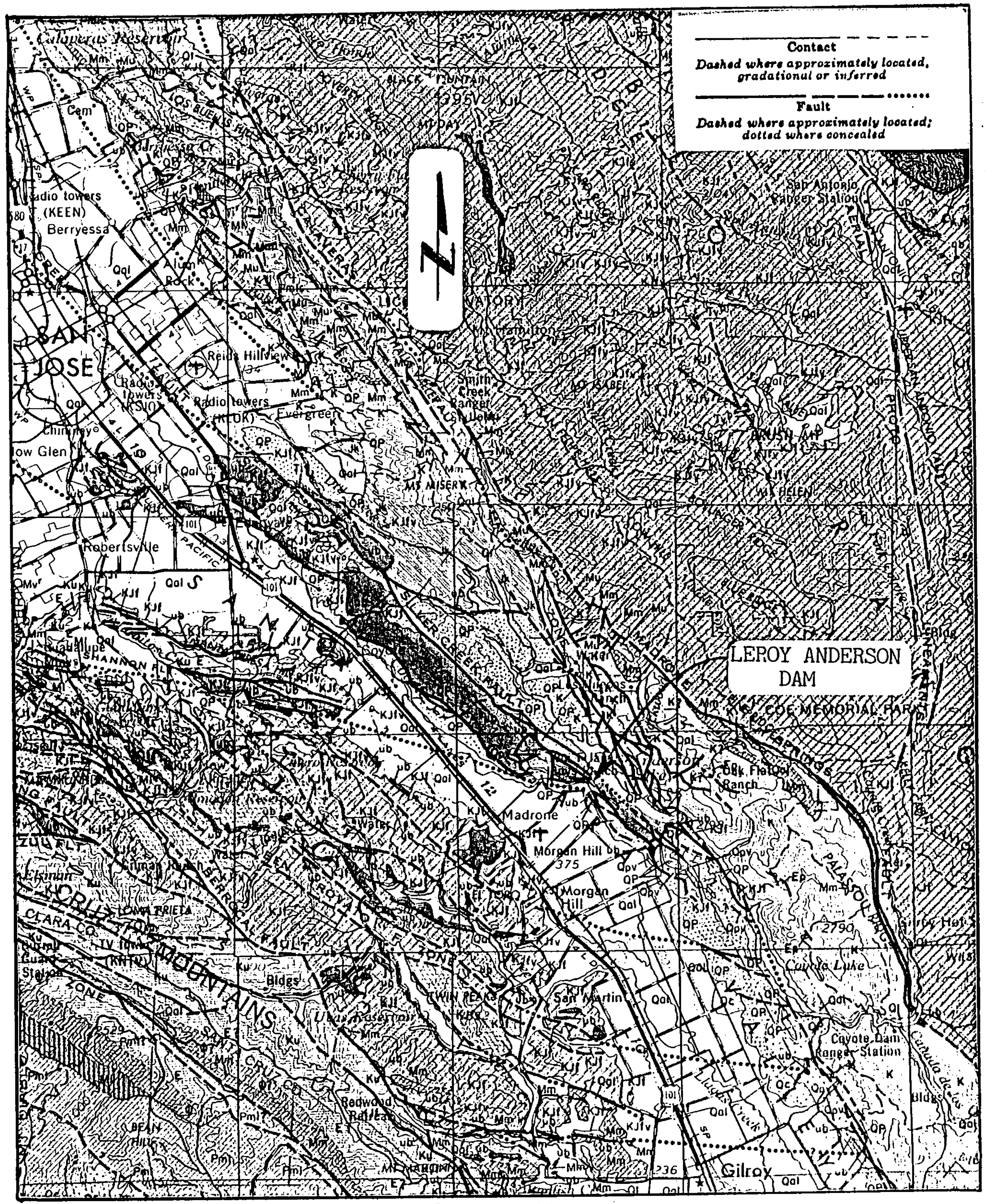
3.4 Reservoir Slope Stability

Numerous slides have been mapped in and near the reservoir in the Santa Clara formation (Reference 13). Many of these slides are active; some are very large. Most of these slides can be expected to move slowly and cause little disturbance in the reservoir.

	Undivided	QTc	Cenozoic nonmarine	QTv	QTv^{a} —andesite; QTv^{b} —basalt; QTv^{p} —pyroclastic rocks
		Tc	Tertiary nonmarine	Ti	Tertiary intrusive (hypabyssal) rocks: Ti^{r} –rhyolite; Ti^{a} –andesite; Ti^{b} –basalt
		Tl	Tertiary lake deposits	Tv	Tertiary volcanic: Tv^{r} —rhyolite; Tv^{a} —andesite; Tv^{b} —basalt; Tv^{p} —pyroclastic rocks
		Tm	Tertiary marine		
MESOZOIC	CRETACEOUS	K	Undivided Cretaceous marine		
		Ku	Upper Cretaceous marine	KJfv	Franciscan volcanic and metavolcanic rocks
		Kl	Lower Cretaceous marine	gr	Mesozoic granitic rocks: gr^{a}-granite and adamellite; gr^{g}-granodiorite; gr^{t}-tonalite and diorite
	JURASSIC	Jk	Knoxville Formation	bi	Mesozoic basic intrusive rocks
		Ju	Upper Jurassic marine	ub	Mesozoic ultrabasic intrusive rocks
		Jml	Middle and/or Lower Jurassic marine	JRv	Jura-Trias metavolcanic rocks
		KJf	Franciscan Formation		
	TRIASSIC	R	Triassic marine		
	UNDIVIDED	m ls	Pre-Cretaceous metamorphic rocks (ls = limestone or dolomite)	mv	Pre-Cretaceous metavolcanic rocks
		ms	Pre-Cretaceous metasedimentary rocks	gr-m	Pre-Cenozoic granitic and metamorphic rocks
PALEOZOIC		P ls	Paleozoic marine (ls = limestone or dolomite)	Pv	Paleozoic metavolcanic rocks
	PERMIAN	P	Permian marine	Pv	Permian metavolcanic rocks
	CARBONIFEROUS	C	Undivided Carboniferous marine	Cv	Carboniferous metavolcanic rocks
		CP	Pennsylvanian marine		
		CM	Mississippian marine		
	DEVONIAN	D	Devonian marine	Dv	Devonian metavolcanic rocks
				Dv?	Devonian and pre-Devonian? metavolcanic rocks
	SILURIAN	S	Silurian marine		
		pSs	Pre-Silurian metasedimentary rocks	pS	Pre-Silurian metamorphic rocks
				pSv	Pre-Silurian metavolcanic rocks
	ORDOVICIAN	O	Ordovician marine		
	CAMBRIAN	Є	Cambrian marine		
		Є?	Cambrian – Precambrian marine	pЄc	Precambrian igneous and metamorphic rock complex
PRECAMBRIAN		pЄ	Undivided Precambrian metamorphic rocks pЄg = gneiss, pЄs = schist	pЄgr	Undivided Precambrian granitic rocks
		lpЄ	Later Precambrian sedimentary and metamorphic rocks		
		epЄ	Earlier Precambrian metamorphic rocks		

PLATE 3-1

Note: Not all geologic units shown in the Explanation appear on the excerpted map


Contact
Dashed where approximately located, gradational or inferred
Fault
Dashed where approximately located; dotted where concealed
LEROY ANDERSON DAM
SAN JOSE
Calaveras Reservoir
Berryessa
Evergreen
Edenvale
Robertsville
Smith Creek Ranger Station
San Antonio Ranger Station
Mt Hamilton
Coe Memorial Park
Madrone
Morgan Hill
San Martin
Coyote Dam Ranger Station
Gilroy
Qal
KJf
KJfv
QP
ub

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

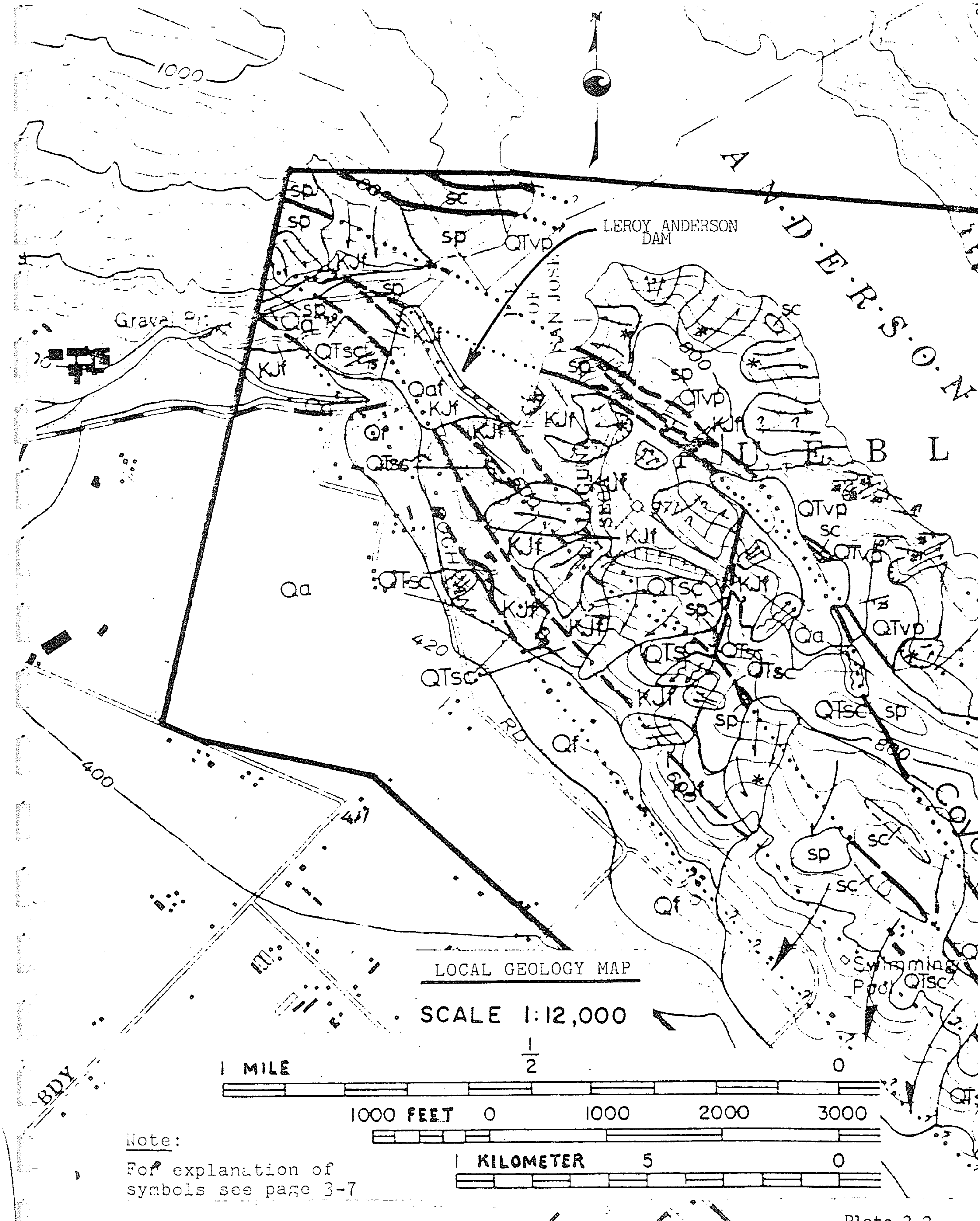
CONTOUR INTERVAL 200 FEET

REGIONAL GEOLOGY MAP

Excerpted from Geologic Map of California, Olaf P. Jenkins Edition, California Division of Mines and Geology

EXPLANATION

Era	System	Series	Symbol	SEDIMENTARY AND METASEDIMENTARY ROCKS	Symbol	IGNEOUS AND META-IGNEOUS ROCKS
CENOZOIC	QUATERNARY	Recent	Qs	Dune sand		
			Qal	Alluvium		
			Qsc	Stream channel deposits (GREAT VALLEY)	Qrv	Recent volcanic: Qrv^r —rhyolite; Qrv^a —andesite; Qrv^b —basalt; Qrv^p —pyroclastic rocks
			Qf	Fan deposits (GREAT VALLEY)		
			Qb	Basin deposits (GREAT VALLEY)		
			Qsl	Salt deposits		
			Ql	Quaternary lake deposits		
			Qg	Glacial deposits		
		Pleistocene	Qt	Quaternary nonmarine terrace deposits		
			Qm	Pleistocene marine and marine terrace deposits	Qpv	Pleistocene volcanic: Qpv^r —rhyolite; Qpv^a—andesite; Qpv^b —basalt; Qpv^p —pyroclastic rocks
			Qc	Pleistocene nonmarine		
			QP	Plio-Pleistocene nonmarine	✳	Quaternary and/or Pliocene cinder cones
	TERTIARY	Pliocene	Pc	Undivided Pliocene nonmarine		
			Puc	Upper Pliocene nonmarine		
			Pu	Upper Pliocene marine	Pv	Pliocene volcanic: Pv^r —rhyolite; Pv^a—andesite; Pv^b —basalt; Pv^p —pyroclastic rocks
			Pmlc	Middle and/or lower Pliocene nonmarine		
			Pml	Middle and/or lower Pliocene marine		
		Miocene	Mc	Undivided Miocene nonmarine		
			Muc	Upper Miocene nonmarine		
			Mu	Upper Miocene marine	Mv	Miocene volcanic: Mv^r —rhyolite; Mv^a —andesite; Mv^b —basalt; Mv^p —pyroclastic rocks
			Mmc	Middle Miocene nonmarine		
			Mm	Middle Miocene marine		
			Ml	Lower Miocene marine		
		Oligocene	Φc	Oligocene nonmarine	Φv	Oligocene volcanic: Φv^r—rhyolite; Φv^a —andesite; Φv^b —basalt; Φv^p—pyroclastic rocks
			Φ	Oligocene marine		
		Eocene	Ec	Eocene nonmarine	Ev	Eocene volcanic: Ev^r —rhyolite; Ev^a—andesite; Ev^b —basalt; Ev^p—pyroclastic rocks
			E	Eocene marine		
		Paleocene	Epc	Paleocene nonmarine		
			Ep	Paleocene marine		



LOCAL GEOLOGY MAP

SCALE 1:12,000

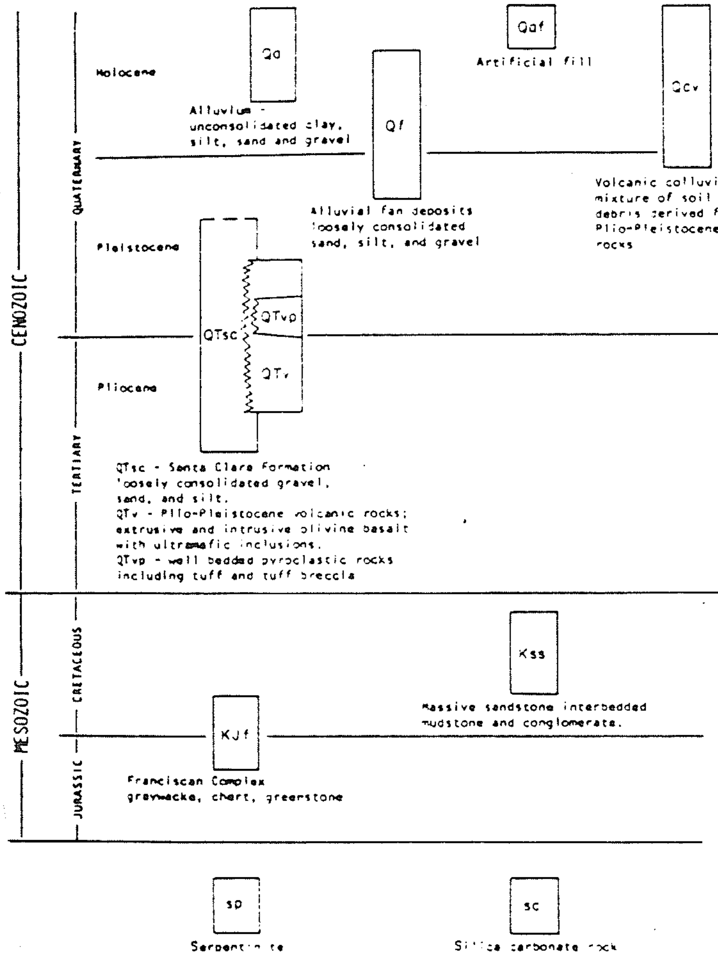
Note:

For explanation of symbols see page 3-7

EXPLANATION

Correlation and description of units

This chart shows the relative age relationships between the geologic units on this map. Box lengths indicate approximate time-equivalence of units; no other implications are intended.



Alluvium - unconsolidated clay, silt, sand and gravel

Alluvial fan deposits loosely consolidated sand, silt, and gravel

Artificial fill

Volcanic colluvium - mixture of soil and rock debris derived from Plio-Pleistocene volcanic rocks

QTsc - Santa Clara Formation loosely consolidated gravel, sand, and silt.
QTv - Plio-Pleistocene volcanic rocks; extrusive and intrusive olivine basalt with ultramafic inclusions.
QTvp - well bedded pyroclastic rocks including tuff and tuff breccia

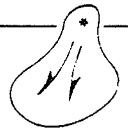
Massive sandstone interbedded mudstone and conglomerate.

Franciscan Complex graywacke, chert, greenstone

Serpentinite

Silica carbonate rock

Debris flow landslides -- deposits of unconsolidated and unsorted rock debris that has moved downslope. Arrows show direction of movement. Query indicates that evidence suggesting the presence of a landslide is equivocal. Dashed line indicates extent of landslide is uncertain. An asterisk denotes an active landslide.



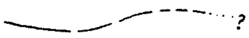
Block slump landslides -- masses of relatively intact to highly disrupted bedrock that have moved downslope by rotational slip along deep, concave slip planes or translational slip along planar surfaces. Because block slumps are composed of large blocks of bedrock, it is often possible to map geologic structure within the landslide mass. This has been done where possible. Debris flow landslides are often superimposed upon or flank the block slumps. Arrows show direction of movement. Query indicates that evidence suggesting the presence of a landslide is equivocal. Dashed line indicates extent of landslide is uncertain. An asterisk denotes an active landslide.

Source: Geology of the Diablo Range, Study Area 11, Wagner, Armstrong, Saucedo, Calif., Div. of Mines and Geology, OFR 78-12-SF, 1978

SYMBOLS

fault -- solid where well located, long dash where approximately located, short dash where inferred, dotted where concealed, query indicates additional uncertainty. Arrows show direction of relative or apparent movement along fault.
U - upthrown side (relative or apparent)
D - downthrown (relative or apparent)

thrust fault -- solid where well located, long dash where approximately located, short dash where inferred, dotted where concealed, query indicates additional uncertainty. Barbs on upper plate.

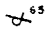


lithologic contact -- solid where well located, long dash where approximately located, short dash where inferred, dotted where concealed, query indicates additional uncertainty.

strike and dip of bedding, number indicates angle of dip in degrees.

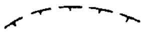
Indicates vertical bedding.

⊕ Indicates horizontal bedding.



Indicates overturned bedding.

study area boundary



headwall scarp of landslides.

slopes showing evidence of recent continuous or intermittent downslope movement of bedrock, soil, and colluvium.

* asterisk denotes active landslides.

Debris-avalanche type slides in the Cochrane Bridge area, however, could move rapidly into the lake and generate small waves. These would be so small as to cause no damage to the embankment and, depending on the water level at the time of slide movement, little or no damage to the spillway structure.

3.5 Foundation Treatment

All overburden materials and soft serpentines were removed during construction, leaving a foundation of firm, in-place sandstone, shale, volcanics, or serpentine. Final cleanup was done by hand, and it was variously rated from poor to excellent.

Extensive excavation was done on the upper right abutment to obtain a firm serpentine or "blue clay" foundation.

Shifting the axis 255 feet upstream provided a foundation of tight shale and volcanics at the upper left abutment, with "blue clay" or gouge reported above Elevation 465.

Eleven test holes were drilled and grouted in the dam foundation. Many holes caved badly, and there were many packer failures. Some water tested tight. Grout takes were high in the upper part of many holes at 30 psi, and many surface leaks occurred. It was judged that it was not feasible to grout the foundation. Leakage occurred later through the upper right abutment.

3.6 Seismicity and Faulting

Leroy Anderson Dam is located within Zone 4 (Great Seismic Probability) on the Seismic Zone Map of California, Nevada, and Arizona, extracted from the U. S. Army Corps of Engineers' Recommended Guidelines, Reference 1, and shown on Plate 3-3, page 3-11.

Estimated earthquake characteristics for the Maximum Credible Earthquake (MCE) on faults most likely to produce severe shaking at the dam are listed below:

Fault	Calaveras	Silver Creek	San Andreas	Hayward
Maximum Credible Earthquake Magnitude (M)	7.5	6.5	8.5	7.5
Probable Sense of Motion	right lateral	dip-slip	right lateral	right lateral
Distance from Dam (km/mi)	1.6/1.0	1.1/0.7	21/13	13/8
Peak Base Acceleration (g) (Bedrock)	0.7	0.65	0.45	0.45

Fault	Calaveras	Silver Creek	San Andreas	Hayward
Duration Bracketed Strong Motion, +0.05g (sec.)	31	19	32	30
Predominant Period (sec.)	0.35	0.30	0.40	0.35
Principal Historic Events	1861, est. M6.5, 1911? M6.6	only microquakes	1906, M8.3	1836, est. M7, 1868, M7.0 ± 0.5

Two traces of the Coyote Creek fault lie under the dam embankment, and a third trace crosses under the outlet at the downstream toe. The Coyote Creek fault has been judged inactive. Sympathetic movement on the Coyote Creek fault, however, might result from a strong earthquake centered nearby on the Calaveras fault. For a maximum credible earthquake, the total sympathetic offset is estimated at 9 inches to one foot, with a potential offset of 2 inches to 6 inches on a single fault trace. (Memorandum by Guy L. Hanegan, November 13, 1979, Appendix F.)

Major faults and stronger epicenters are shown on Plate 3-4, page 3-13.

3.7 Evaluation

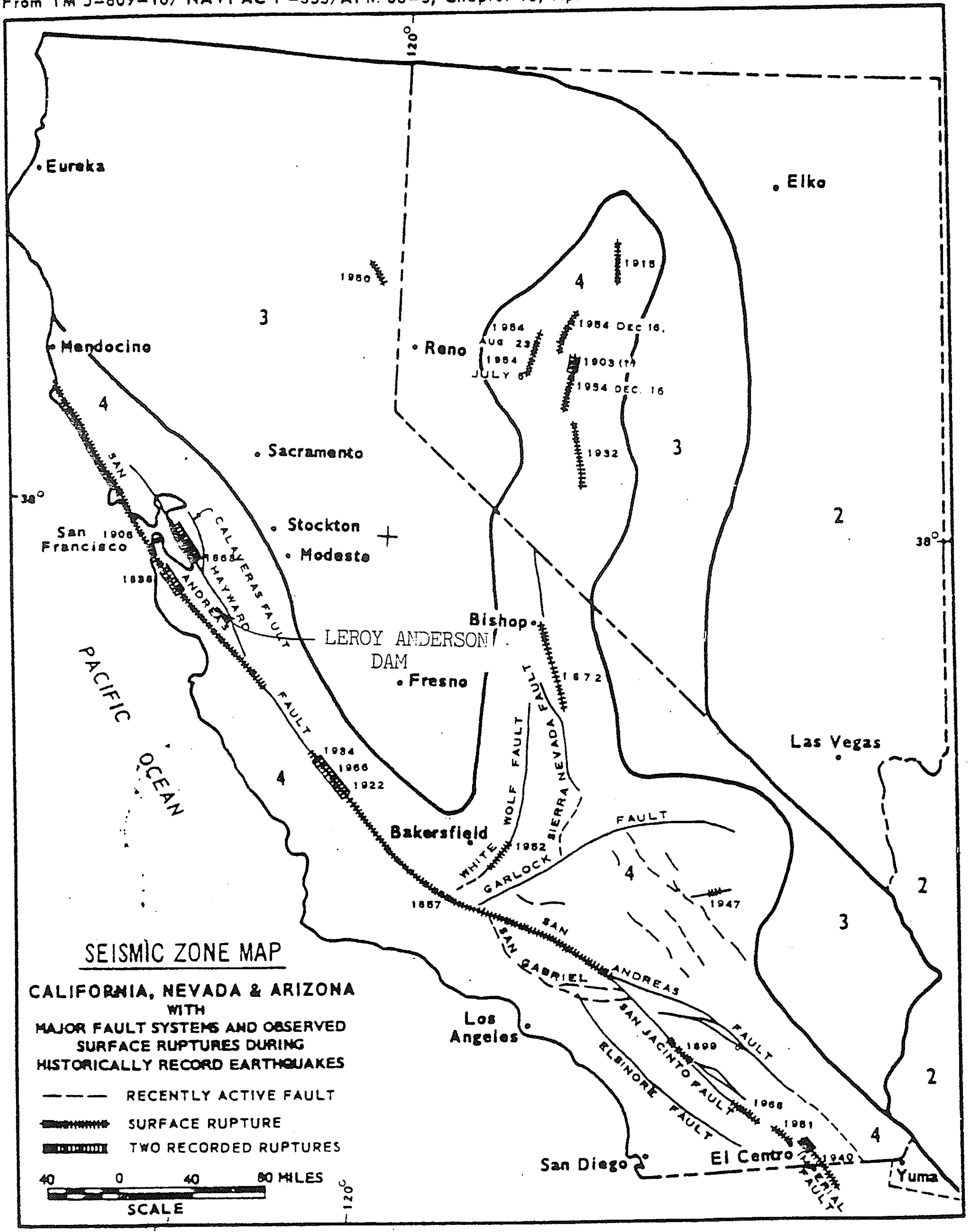
Two inches to 6 inches of differential offset could occur on a single trace of the Coyote Creek fault. Two such traces lie under the embankment and a third crosses the outlet near the downstream toe of the dam.

The landslide on the left abutment is limited in extent, and the lower portion is stable enough that it will not interfere with the intake structure.

Landslides in the reservoir area could be activated either by seismic activity or by excessive precipitation. Movements would be sufficiently slow or the volume of water displaced would be sufficiently small, that only minor wave action would result.

There are no geologic deficiencies which would prevent the dam and appurtenant structures from functioning under any foreseeable circumstances.

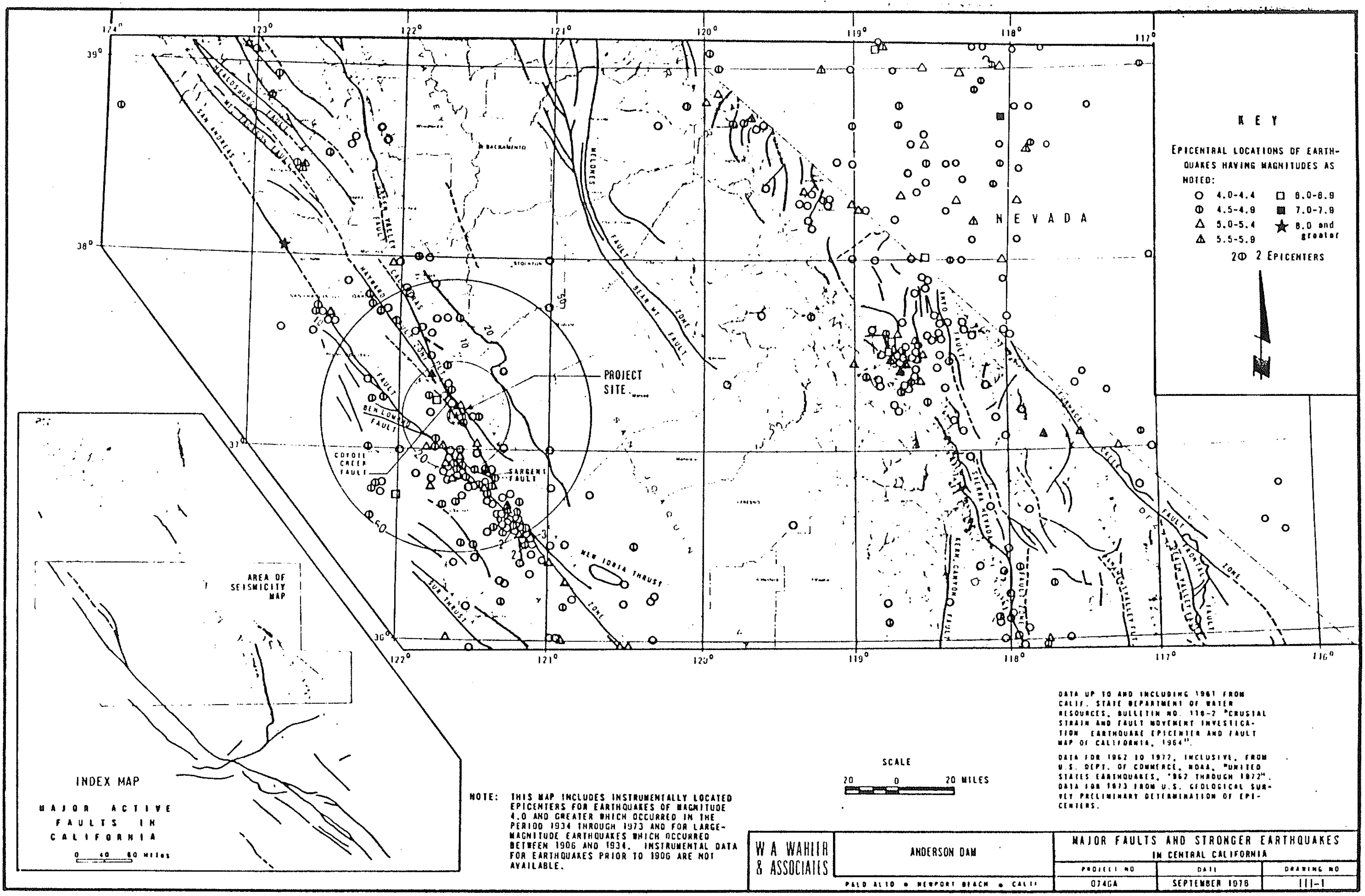
From TM 5-809-10/ NAVFAC P-355/AFM 88-3, Chapter 13; April 1973



SEISMIC ZONE MAP

CALIFORNIA, NEVADA & ARIZONA
WITH
MAJOR FAULT SYSTEMS AND OBSERVED SURFACE RUPTURES DURING HISTORICALLY RECORD EARTHQUAKES

Figure 2



NOTE: THIS MAP INCLUDES INSTRUMENTALLY LOCATED EPICENTERS FOR EARTHQUAKES OF MAGNITUDE 4.0 AND GREATER WHICH OCCURRED IN THE PERIOD 1934 THROUGH 1973 AND FOR LARGE-MAGNITUDE EARTHQUAKES WHICH OCCURRED BETWEEN 1906 AND 1934. INSTRUMENTAL DATA FOR EARTHQUAKES PRIOR TO 1906 ARE NOT AVAILABLE.

DATA UP TO AND INCLUDING 1961 FROM CALIF. STATE DEPARTMENT OF WATER RESOURCES, BULLETIN NO. 116-2 "CRUSTAL STRAIN AND FAULT MOVEMENT INVESTIGATION EARTHQUAKE EPICENTER AND FAULT MAP OF CALIFORNIA, 1964".

DATA FOR 1962 TO 1972, INCLUSIVE, FROM U.S. DEPT. OF COMMERCE, NOAA, "UNITED STATES EARTHQUAKES, 1962 THROUGH 1972". DATA FOR 1973 FROM U.S. GEOLOGICAL SURVEY PRELIMINARY DETERMINATION OF EPICENTERS.

W A WAHLER
& ASSOCIATES

ANDERSON DAM

PALO ALTO • NEWPORT BEACH • CALIF

MAJOR FAULTS AND STRONGER EARTHQUAKES IN CENTRAL CALIFORNIA

PROJECT NO	DATE	DRAWING NO
074GA	SEPTEMBER 1976	III-1

PLATE 3-4

4. VISUAL INSPECTION

4.1 General

Leroy Anderson Dam was inspected on September 29, and October 7, 1980, by the following personnel:

Santa Clara Valley Water District

Mr. Don Earling, Engineer
Mr. Don Erba, Maintenance Division
Mr. Riley Beebe, Engineering Technician

California Division of Safety of Dams

Mr. E. Dean Stetson, Field Engineer
Mr. Glen Swanson, Associate Engineer

At the time of the September 29, 1980 inspection, the reservoir water surface was at Elevation 611.9, or 13.1 feet below the level of the spillway crest. The weather was clear and warm. There had not been any recent precipitation at the damsite prior to the inspection.

A supplementary inspection of the outlet interior was made by Mr. E. Dean Stetson on October 21, 1980.

The dam is observed daily by SCVWD personnel. They also make a thorough inspection immediately following any occurrence such as an earthquake. Thorough inspections are made jointly by DSOD and SCVWD semiannually.

There are no emergency warning devices to detect rapidly changing conditions at the dam or in the downstream channel.

4.2 Dam Embankment

The crest, slopes, and contact areas were free of cracks, slumps, or any other indications of instability or distress. Some minor brush and seedling trees were growing on the downstream slope; however, this growth did not obstruct viewing the slope for a thorough inspection. Mr. Stetson made a request to Mr. Erba for removal of the small trees and control of the brush.

The dam embankment is shown on Photo Nos. 4.1, 4.2, and 4.3 at the end of this chapter.

The downstream slope, groins, and toe area were dry. There was no visible evidence of seepage through the dam, foundation, or adjacent abutments. Mr. Erba reported that, as far as he knew, there had never been any visible leakage through the dam or adjacent abutments.

There was minor erosion on the upstream slope just below the outlet control house on the dam crest. This was caused primarily by foot traffic of fishermen, etc., and is of no significance relating to the safety of the dam.

4.3 Spillway

The spillway crest (see Photo No. 4.4) and reinforced concrete-lined chute (see Photo No. 4.5) were free of obstructions. The log boom in the spillway approach channel (see Photo No. 4.6) was in satisfactory condition.

Some wide, deep seated cracking exists in the ogee weir and at the terminal end of the lined chute, see Photo Nos. 4.7 , 4.8 , and 4.9. There is visible distortion associated with this cracking only at the right end of the ogee weir.

There is no exudation or other indication of an occurring alkali-aggregate reaction within the concrete. The fine pattern cracking visible in Photo No. 4.8 appears to be limited to a surface coat of plaster apparently placed subsequent to the mass of the weir. No deep cracking was observed in the channel walls or invert. The deep cracking observed is not extensive enough at this time to be of concern during operation of the spillway.

The drainage for the spillway channel was dry from the crest to approximately Station 7+00. Below Station 7+00 most of the weep holes were passing some flow. The largest flows were emitted from weep holes at the base of the right wall where at approximate Station 7+00 (Elevation 567) two weepholes were passing about 5 gpm each, and at approximate Station 10+00 (Elevation 543) two weepholes were passing about 10 gpm each. At the terminal end of the concrete channel, 2 of the 6 drain outfalls were passing a total estimated flow of 20 gpm. These outfalls are from the 12-inch thick rock drain beneath the downstream 200 feet of the channel invert. Photo No. 4.10 shows the general drainage in the spillway channel.

There was no indication of differential settlement or movement on any of the reinforced concrete slabs forming the invert, nor was there any indication of movement on the channel walls. From appearances, the general condition of the reinforced concrete in the spillway channel remains satisfactory. There were no eroded areas behind the spillway walls.

4.4 Outlet Works

The inspection of the outlet works on September 29, 1980, did not include the interior of the outlet. The upstream valve was fully open and discharge was controlled by the downstream butterfly valve.

The hand operated hydraulic controls for the upstream slide gate appeared to be in good condition. They are shown in Photo No. 4.11. The upstream slide gate is operated through its full cycle annually. Mr. Erba reported that it takes between two and three hours to fully open or close the upstream gate.

The redwood box, encasing the hydraulic lines on the upstream face of the dam, was intact. It is shown in Photo No. 4.12 There were no indications of any problems associated with the upstream slide gate controls.

The downstream butterfly valve is housed in a vault below the toe of the dam. This valve is operated regularly for controlling the quantities of releases. Normal operation is with electrical power. There is no alternate source of electrical power; however, the valve can also be operated manually. From appearances, the downstream valve and controls were in good condition.

On October 21, 1980, the upstream valve was fully closed and the interior of the outlet was inspected by Mr. E. Dean Stetson of DSOD and Mr. Riley Beebe of SCVWD. Their inspection terminated a short distance from the upstream end of the conduit as the fresh air supply was inadequate. After inspecting nearly the full length of the outlet interior, they reported it to be in good condition with no signs of distress.

As determined from the visual inspection, the outlet works are in satisfactory condition.

4.5 Instrumentation

Instrumentation at Leroy Anderson Dam consists of survey monuments on the dam crest, piezometers within the dam embankment, and staff gages for monitoring the reservoir level. The instrumentation is discussed in Section 6.6.

The staff gages are pipes firmly embedded in concrete on the upstream slope. They are visible in Photo No. 4.12. The monuments on the dam crest, for measurement of movement, are well protected in covered casings. Photo No. 4.13 shows a typical cover for these monuments.

4.6 Reservoir

The reservoir level was at Elevation 611.9, which is 13.1 feet below the spillway crest, at the time of the visual inspection.

The perimeter of the reservoir was not included in this inspection. However, the slide area on the left abutment just upstream from the dam was inspected. This slide area was unloaded by grading in 1970 and a paved parking area was constructed on a portion of it. No cracks or other indications of movement were detected in the area. This area is shown on Photo No. 4.14.

Numerous active slides exist around the reservoir perimeter. With the exception of slides in the Cochrane Bridge area, on the Coyote Creek leg of the reservoir a considerable distance from the dam, these slides can be expected to move slowly without causing significant disturbance in the reservoir. The slides in the vicinity of the Cochrane Bridge, although having a potential for rapid movement, are not large enough to cause waves which would be damaging to the dam embankment. The slides are discussed in Section 3.4 of the preceding chapter on Geology. Regular inspections of the reservoir perimeter are not included in the owner's surveillance program.

4.7 Watershed

The 194.3 square mile watershed contributing to Leroy Anderson Reservoir is mountainous. The elevation varies from 3414 at the highest peak to 625 at the dam. Cover is grass with large areas of brush and a few trees. Mr. Don Erba verfied that there has not been any major development on the watershed which could influence infiltration, sedimentation, and runoff.

4.8 Downstream Channel

Downstream of Leroy Anderson Dam, Coyote Creek passes through agricultural and residential property along the east side of Santa Clara Valley. It is an unimproved channel for a distance of approximately 15 miles prior to passing through the metropolitan area of San Jose. Coyote Creek discharges into San Francisco Bay about 28 miles from the dam.

4.9 Evaluation

There were no visible indications of instability or leakage in the embankment or adjacent abutments.

Although some deep cracking was observed in the spillway concrete, the spillway is serviceable and the deep cracking is not extensive enough at this time to be of concern during spillway operation.

The outlet works are operable and in good condition.

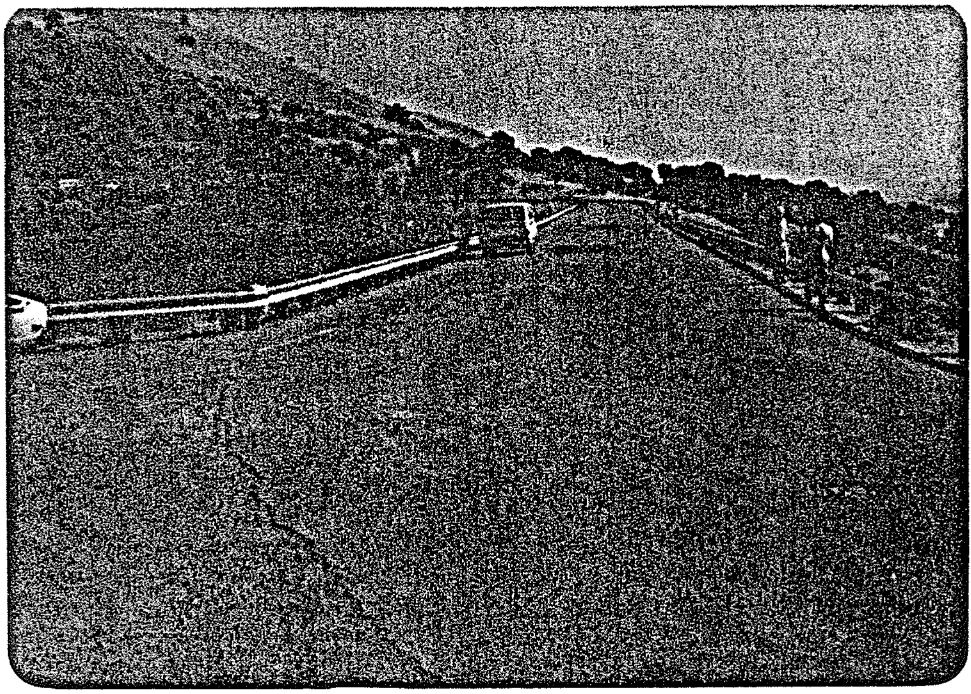


Photo No. 4.1
The dam crest. The outlet control house can be seen behind the truck.

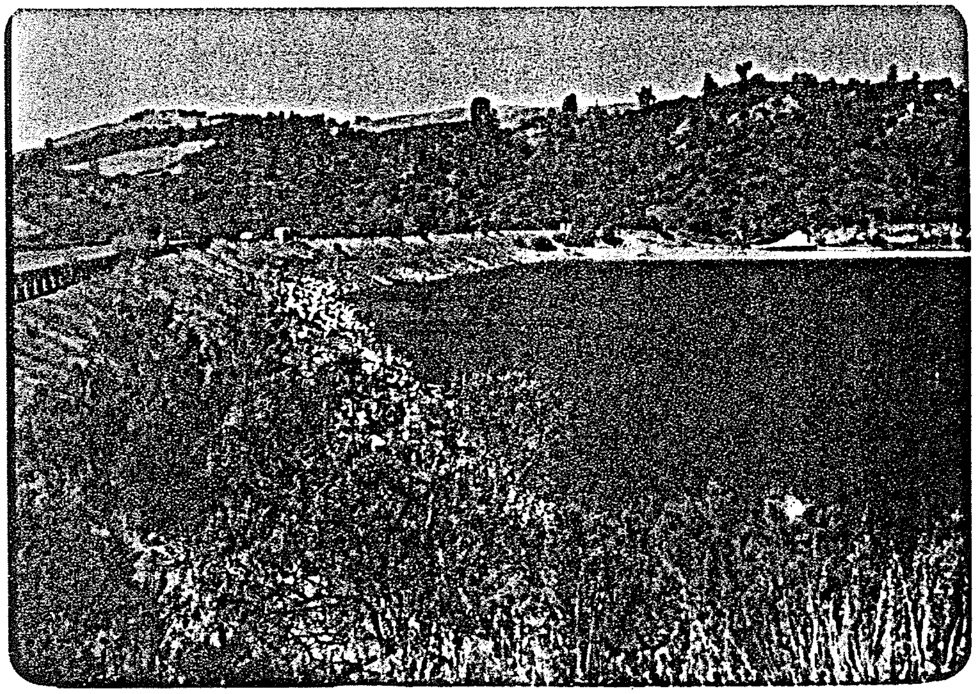


Photo No. 4.2
The upstream side of the embankment. The spillway entrance can be seen at the right.

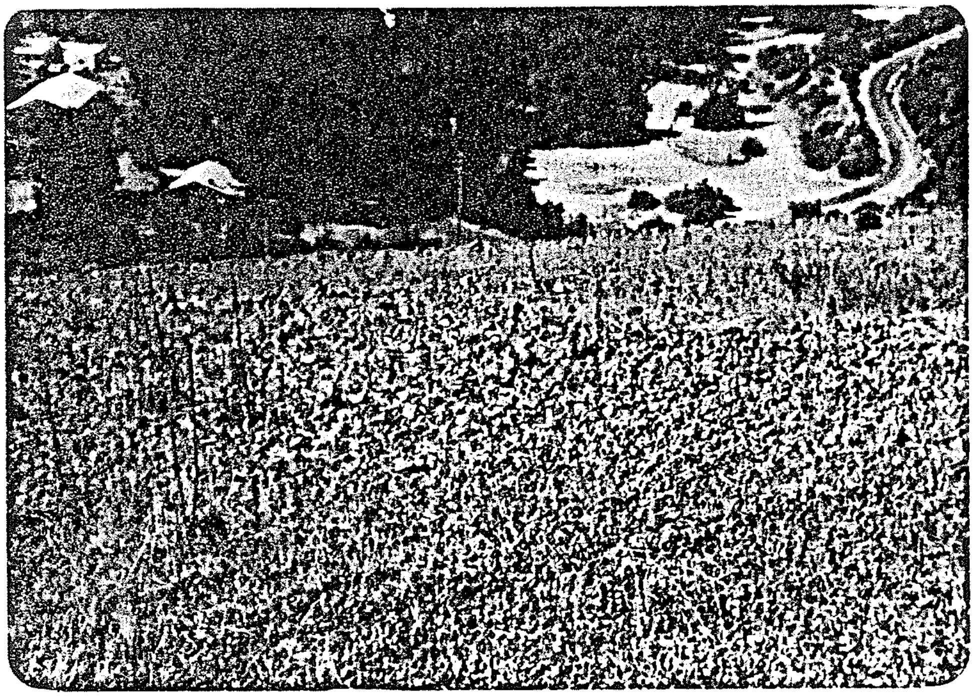


Photo No. 4.3
The downstream slope of the embankment as viewed from the outlet control house on the crest.

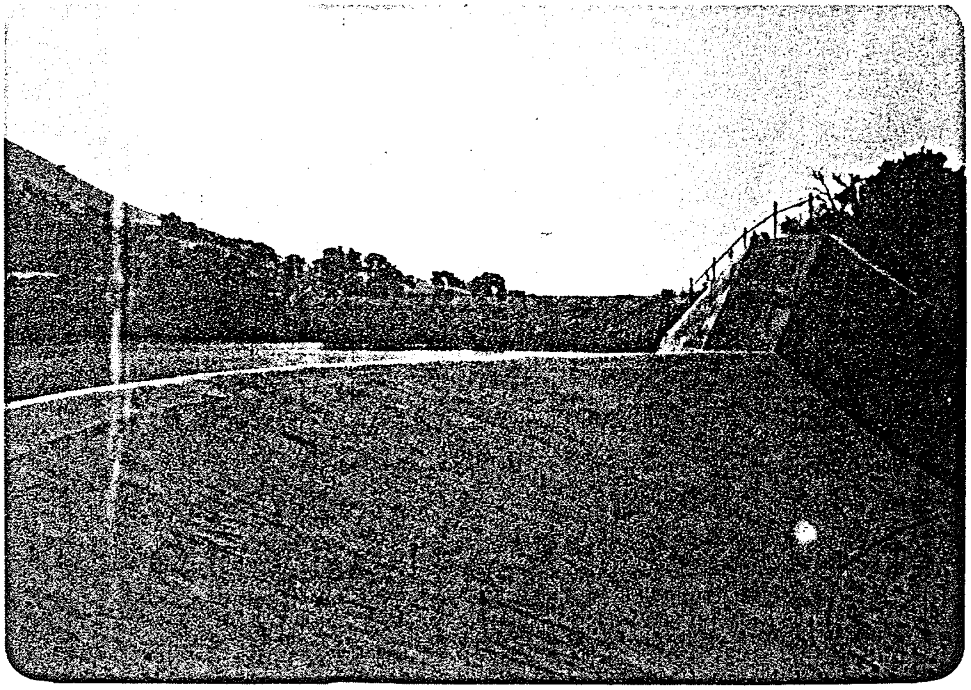


Photo No. 4.4
The spillway crest.

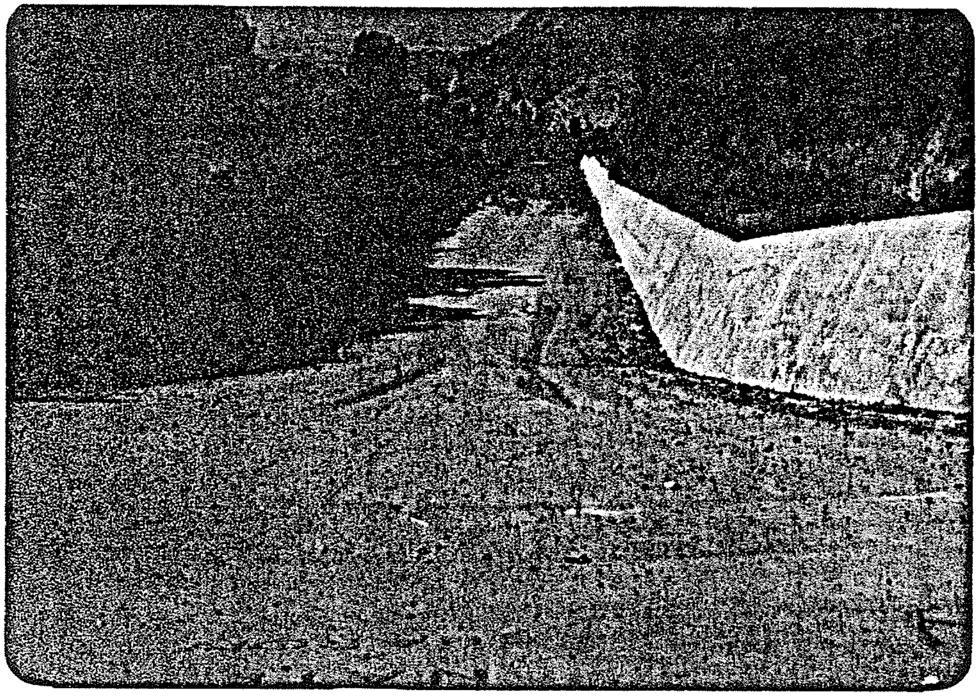


Photo No. 4.5
The concrete spillway channel as viewed from the crest section. Note the location of drainage entering the channel.

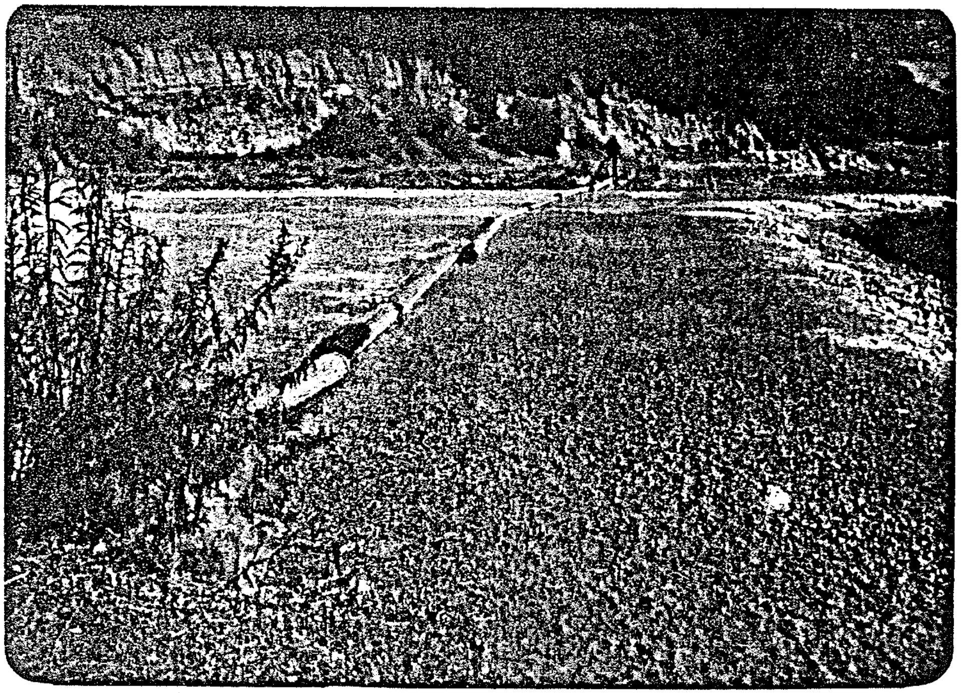


Photo No. 4.6
The log boom in the spillway approach channel.

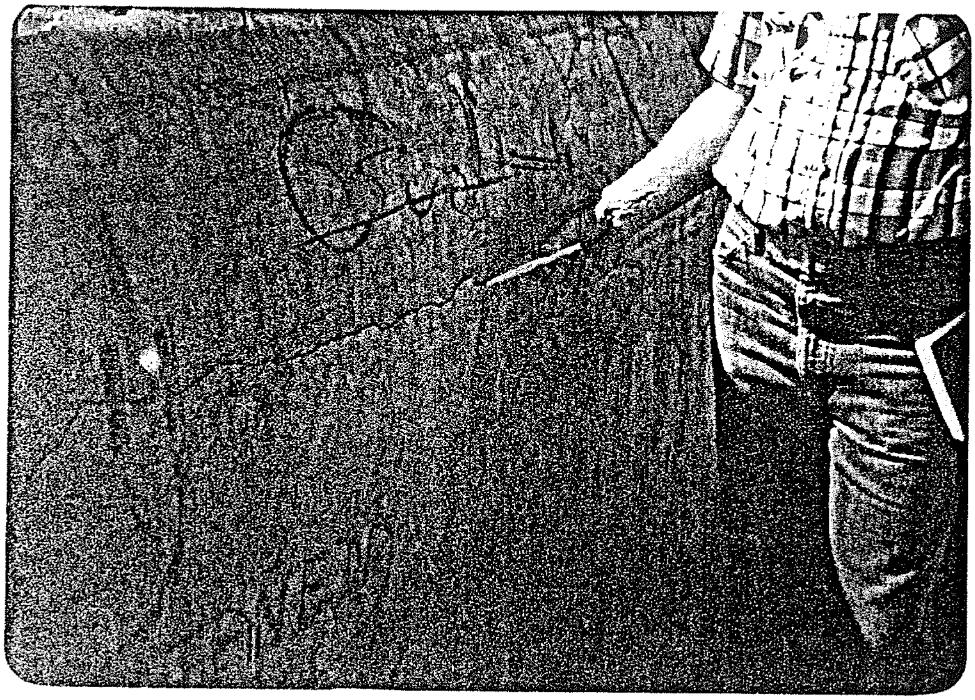


Photo No. 4.7
An example of the deep seated cracking in the spillway ogee weir section.

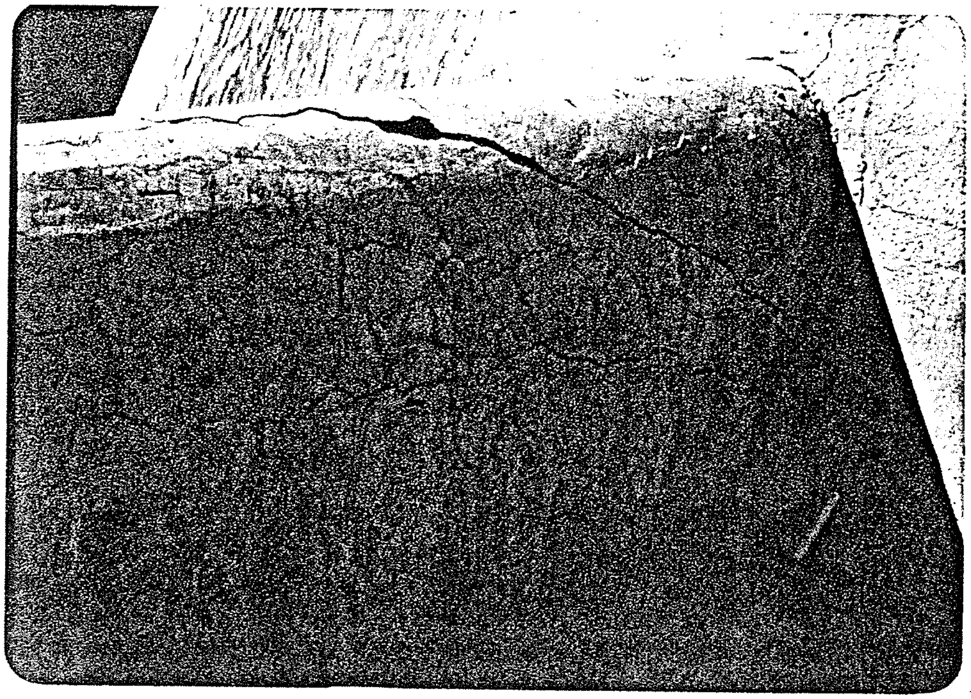


Photo No. 4.8
The most severe area of deep cracking in the spillway ogee weir section. This is adjacent to the right spillway wall.

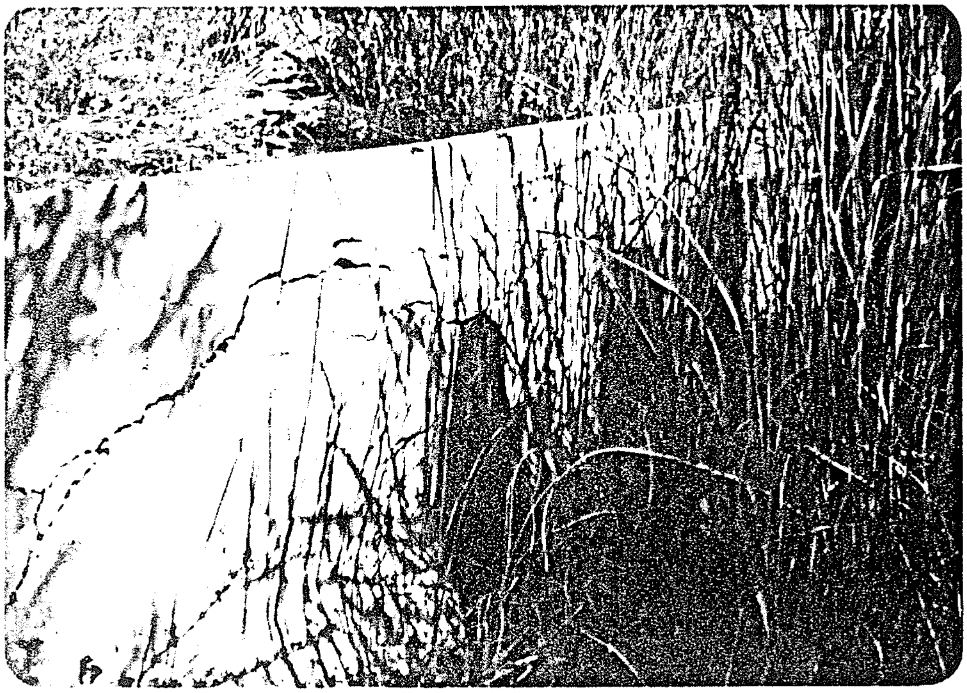


Photo No. 4.9
Deep cracks in the terminal end of the concrete spillway channel. The dark areas in the photo are from water leaking through the cracks.

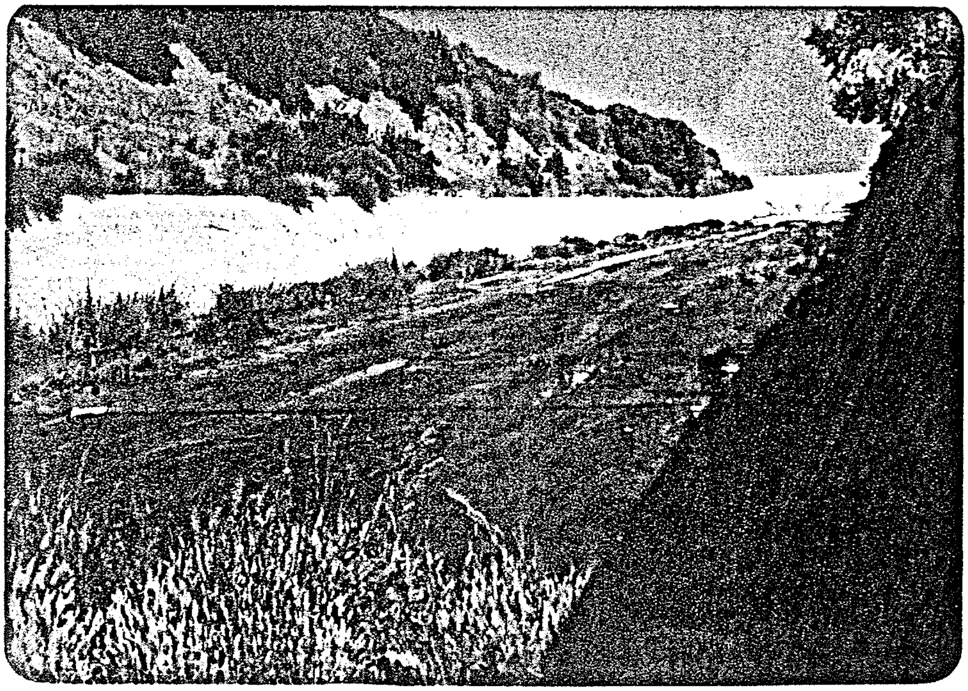


Photo No. 4.10
General drainage in the spillway channel.

Photo No. 4.11
The hand operated hydraulic controls for the upstream slide gate.

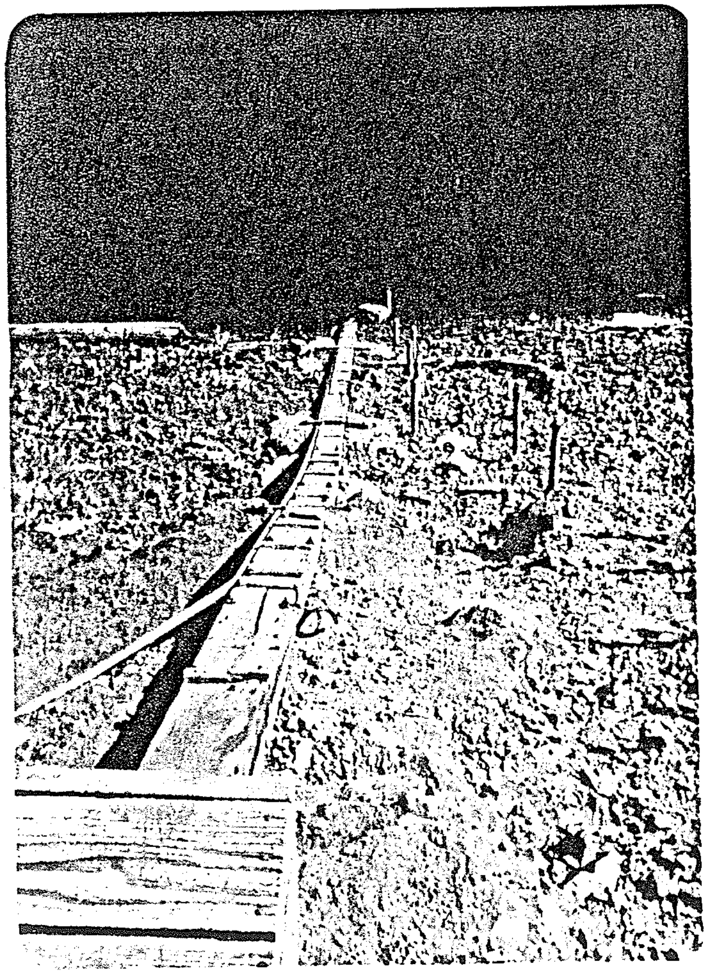


Photo No. 4.12

The redwood encasement for the hydraulic lines to the upstream headgate

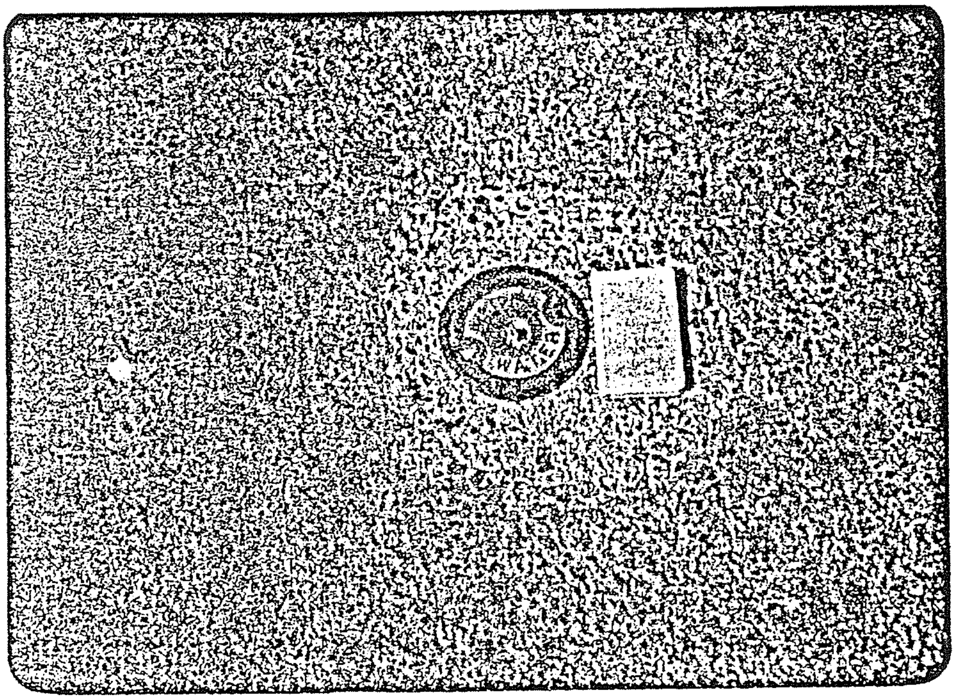


Photo No. 4.13
A typical cover which protects the survey monuments on the dam crest.

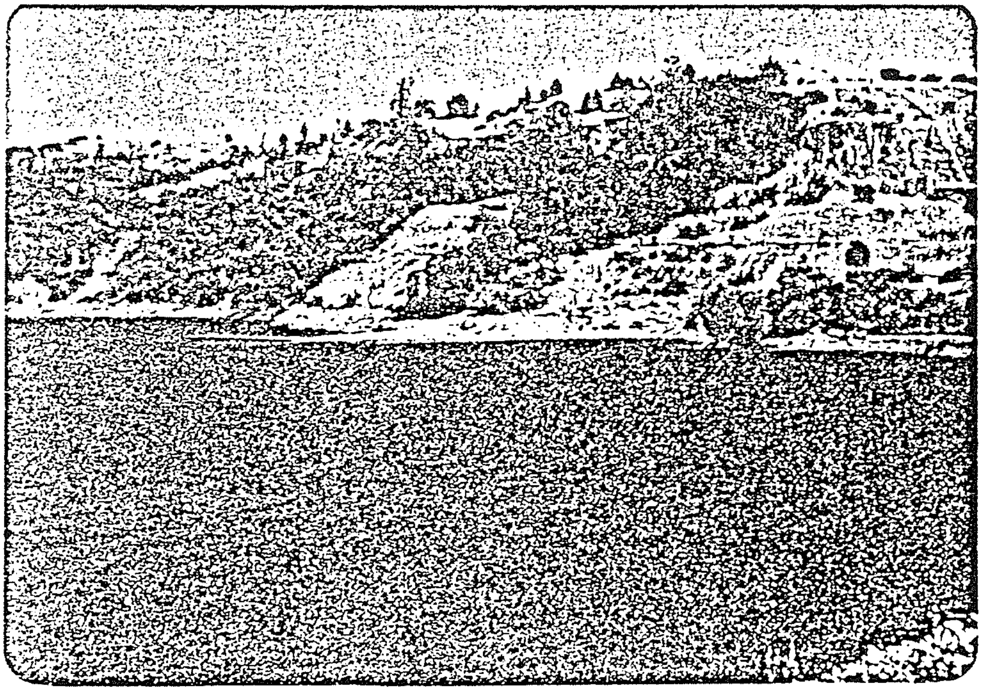


Photo No. 4.14
The old slide area on the left upstream abutment.

5. HYDROLOGY AND HYDRAULICS

5.1 General

The original hydrologic study was prepared by the owner in 1949 prior to construction of Leroy Anderson Dam. Runoff considered in that study was 259 cubic-feet per second (cfs) per square mile for the portion of the watershed above Coyote Reservoir, and 415 cfs per square mile for the remainder of the watershed. Routing this flood through the reservoir produced a peak spillway discharge of 23,900 cfs.

The DSOD also made a hydrology study in 1949. The flood produced during this study had a recurrence interval of 1:1,000 years. The peak inflow was 25,520 cfs. Routing through the reservoir produced a peak spillway discharge of 18,000 cfs.

5.2 Spillway Design Flood

Based on Table 3 in the U.S.C.E. Recommended Guidelines (Reference 1), a Probable Maximum Flood(PMF) should be used as the Spillway Design Flood(SDF), i.e. the largest flood that need be considered in evaluating the project.

A PMF was developed based on Probable Maximum Precipitation (PMP) for a general storm of 72 hours using the method outlined in "Hydrometerological Report No. 36, Interim Report Probable Maximum Precipitation in California" (Reference 5).

Clark's unit graph technique was used to obtain the runoff characteristics. The times of concentration TC and Clark's R values were estimated using the relationships developed by the U. S. Army Corps of Engineers (Reference 6).

Computer programs "Unit Graph and Hydrograph Computation (23-J2-L228)" and "Hydrograph Combining and Routing (23-J2-L232)" prepared by the U. S. Army Corps of Engineers were used to compute the inflow and outflow quantities.

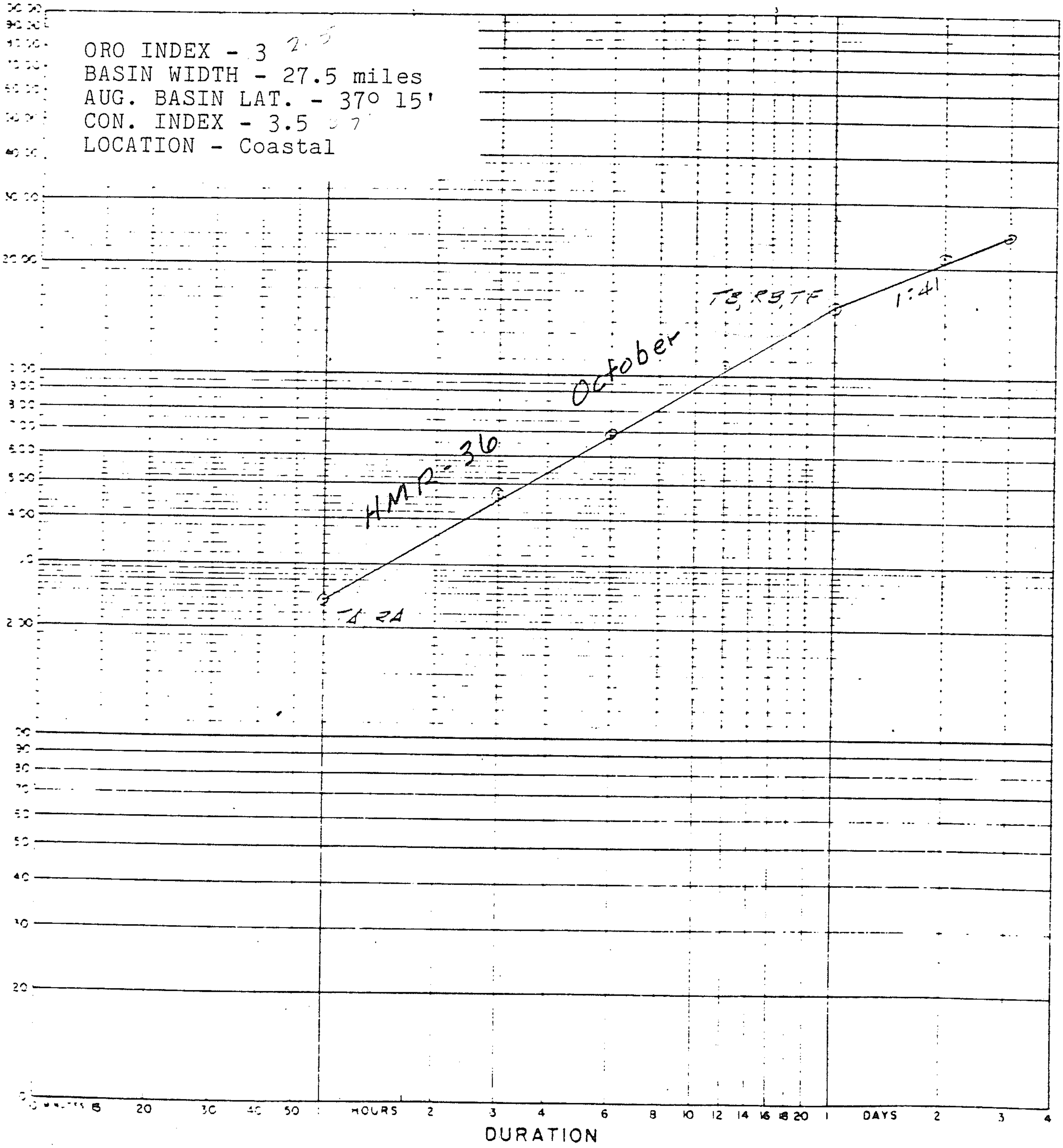
24 & 26 [illegible]

Precipitation for the 72-hour storm totaled 24 inches. Total storm runoff, or rainfall excess, for the basin was 19.21 inches, 80 percent of the total storm precipitation. Peak inflow to Leroy Anderson Reservoir was 60,224 cfs. The Precipitation Depth-Duration-Frequency curve and the Reservoir Inflow and Outflow Hydrographs for the PMF are on the following two pages.

THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

PRECIPITATION DEPTH - DURATION - FREQUENCY CURVE

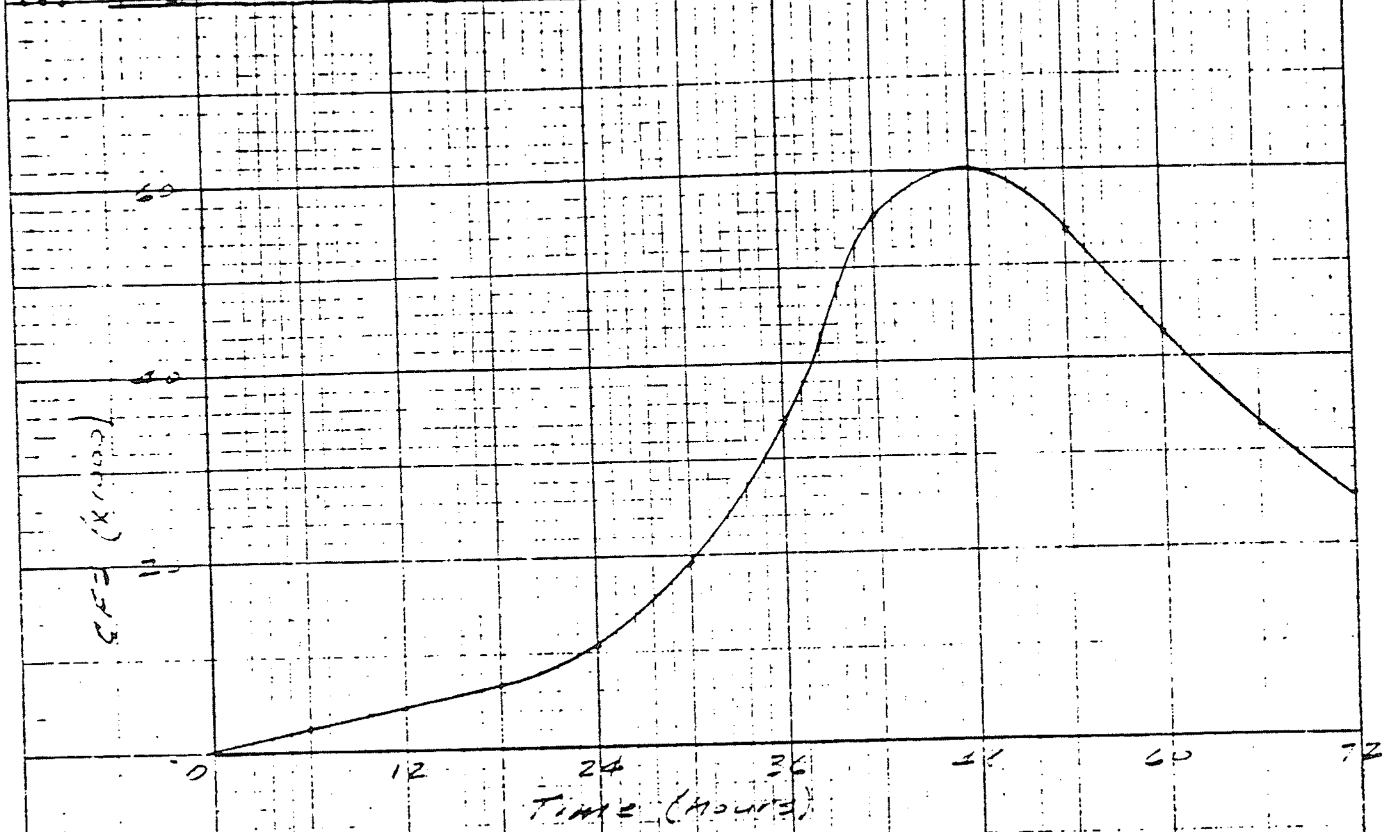
NAME OF DAM [illegible] No. 7 CALCULATED BY [illegible] DATE [illegible]



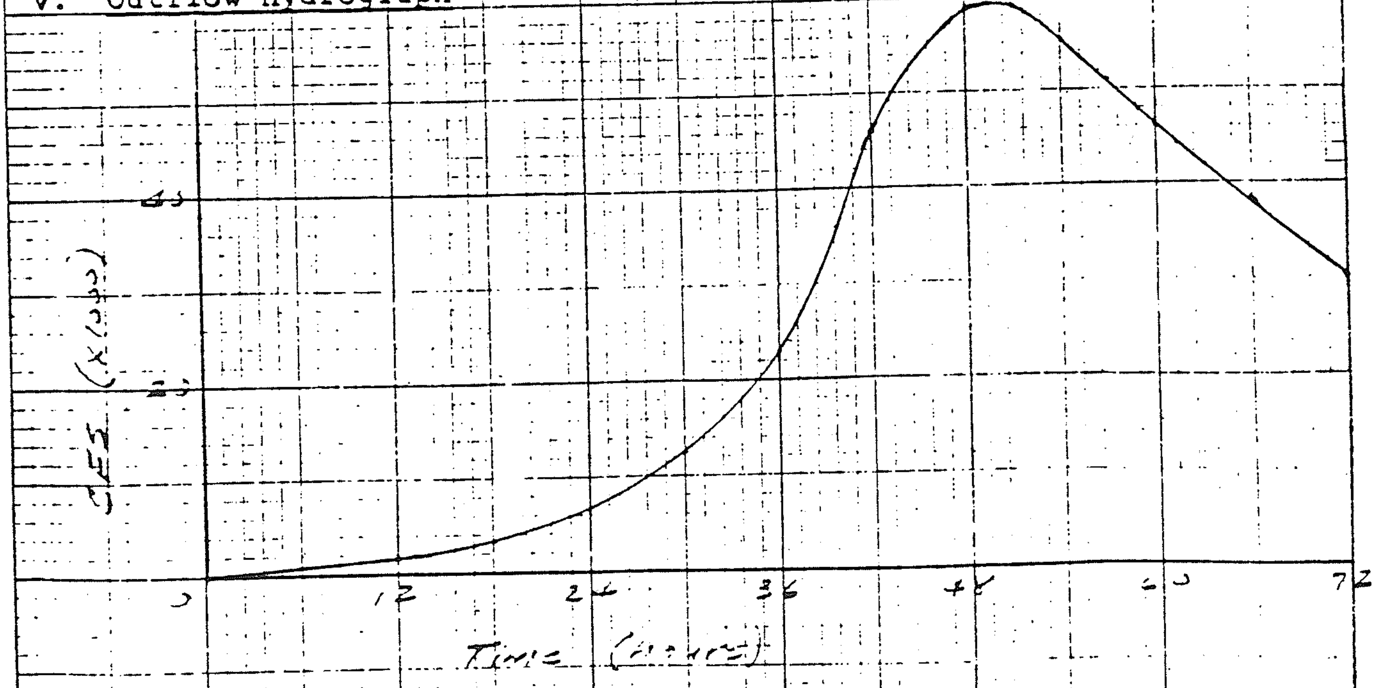
ORO INDEX - 3 2.5
BASIN WIDTH - 27.5 miles
AUG. BASIN LAT. - 37° 15'
CON. INDEX - 3.5 3.7
LOCATION - Coastal

DWR 344

IV. Adopted Inflow Hydrograph



V. Outflow Hydrograph



5.3 Flood Routing and Spillway Hydraulics

In routing the PMF, the reservoir level was assumed to be at the spillway crest at the onset of the storm. Outlet releases were not considered. Routing produces a peak outflow of 57,442 cfs with the maximum reservoir surface at Elevation 642.5, which is 2.5 feet higher than the dam crest as shown on the as-built drawings.

The maximum spillway capacity with the reservoir level at the crest of the dam is 42,200 cfs. A coefficient of 3.8 was used for the ogee weir in computing the spillway capacity. To complete the routing for the peak flows, a coefficient of 2.63 was used for flows over the dam crest. Overtopping of the earth and rock embankment would continue a total of 23 hours with the maximum overflow of 2½ feet lasting nearly 2 hours. Coyote Dam would not be overtopped by the PMF.

The spillway rating curve, the area and capacity curves, and a summary of the flood hydrology are included on the following four pages. Computer input and output data for the hydrographs and routing are included in Appendix C.

Additional computer runs were made to determine what percentage of the PMF would pass through the spillway without overtopping the dam. These runs assumed the reservoir level was 56 feet below the spillway crest (the normal Fall storage level) at the start of the storm. It was determined that slightly over 80 percent of the PMF would pass with zero freeboard assuming the lower initial reservoir level. A summary of the flood hydrology is shown on page 5-15 and the computer printout of the 80 percent PMF storm is included in Appendix C.

For moderate flows in the spillway, there is some question about the hydraulic characteristics. In 1958 the spillway passed flows up to about 5,000 cfs. Due to the rapid convergence below the weir section, cross waves occurred at three points in the concrete channel. At one point, it was observed that the side wall had apparently been overtopped. Photo Nos. 5.1, 5.2, and 5.3 at the end of this chapter show the flow characteristics in the spillway with the reservoir surface 3.1 feet above the spillway crest.

5.4 Outlet Works Hydraulics

The outlet works are described in preceeding Section 2.7. The owner reports that the maximum capacity of the outlet is 500 cfs with the reservoir level at Elevation 625, the spillway crest. The reservoir could be drawn down 30 feet in approximately 32 days, by releasing through the outlet, if there were no inflow to the reservoir. Operation of the outlet would not reduce the peak reservoir stage significantly during the PMF.

46 0780

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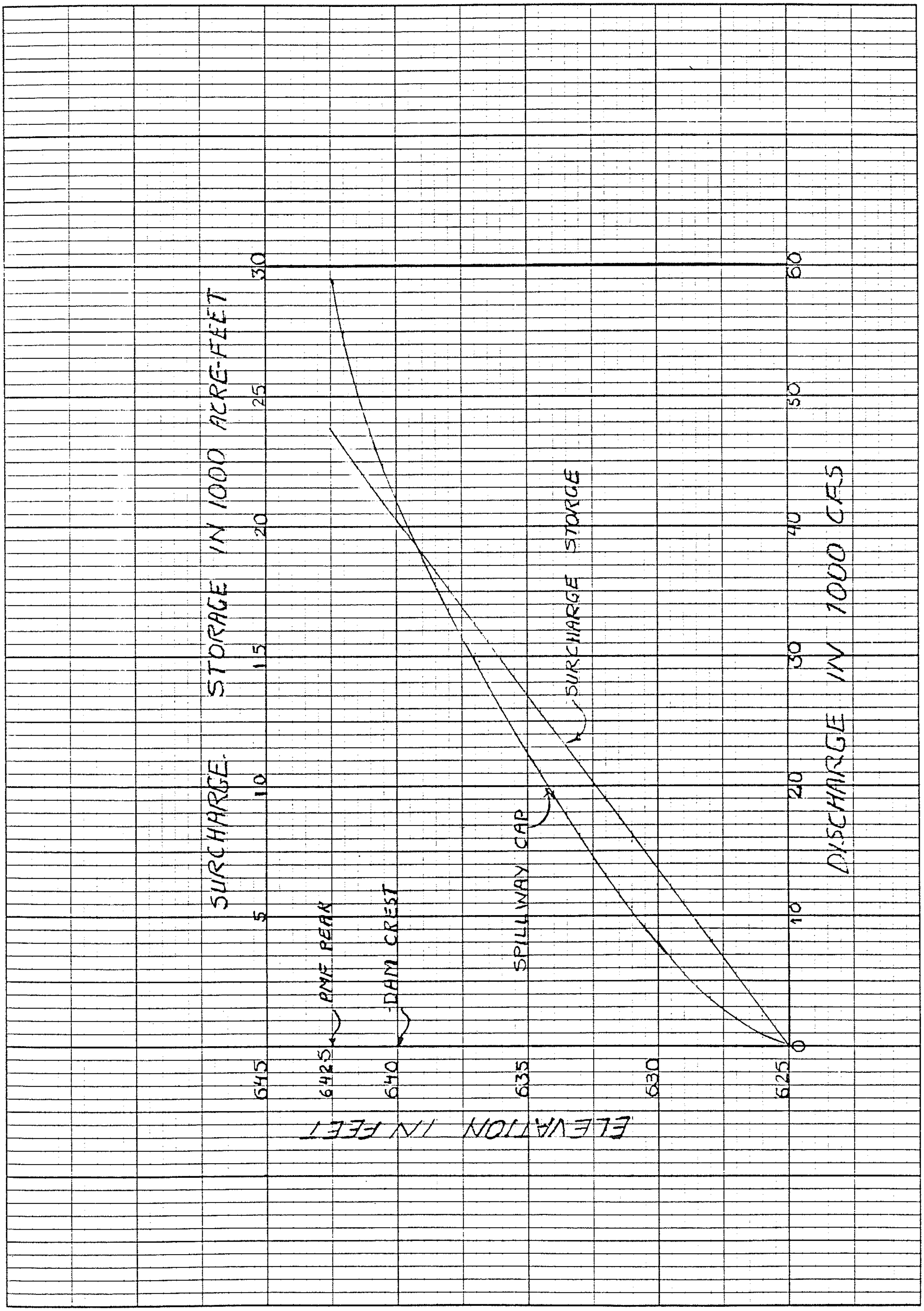
KEUFFEL & ESSER CO. MADE IN U.S.A.



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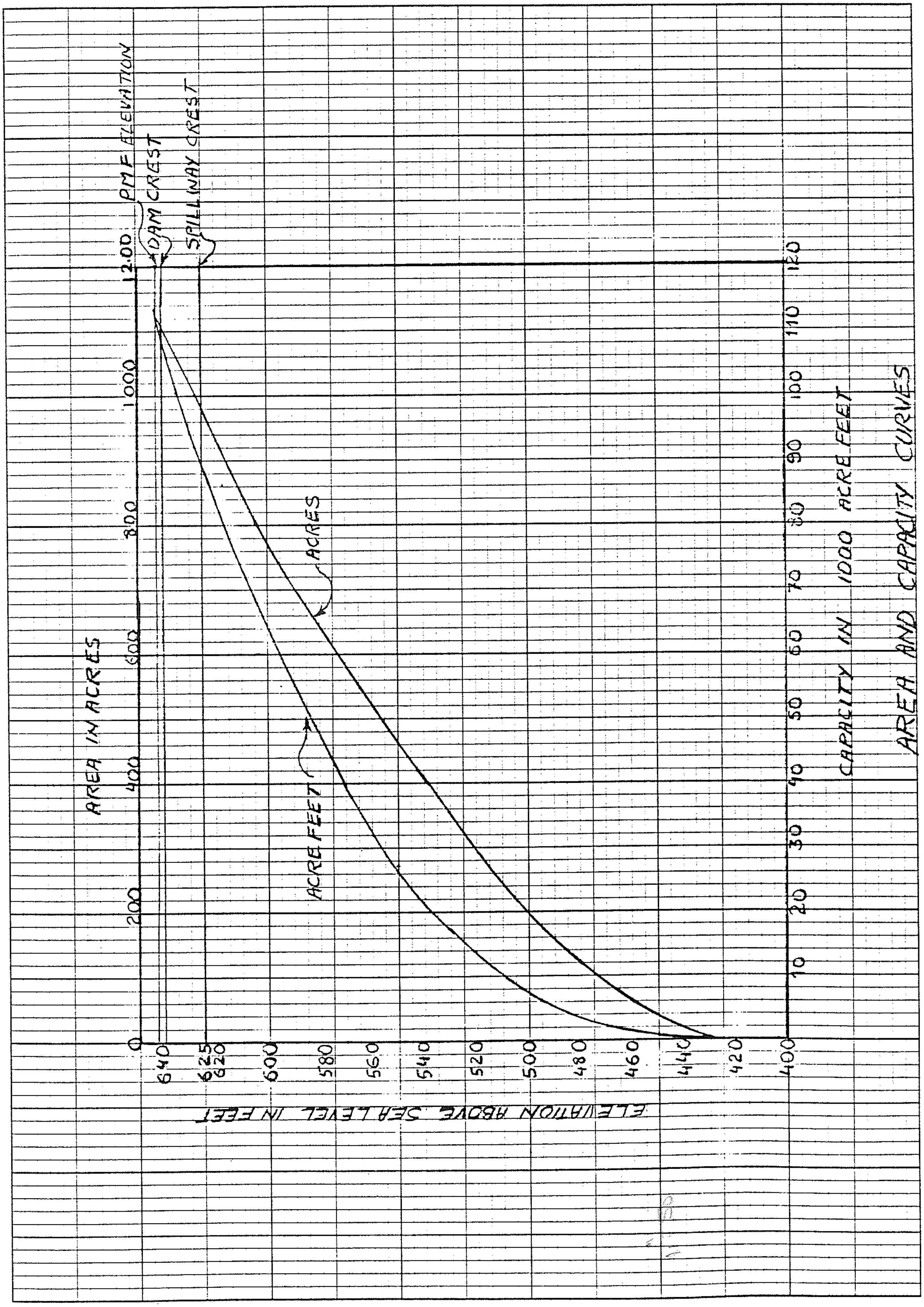


AREA AND CAPACITY CURVES

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
Division of Safety of Dams

FLOOD ESTIMATE AND SPILLWAY ANALYSIS

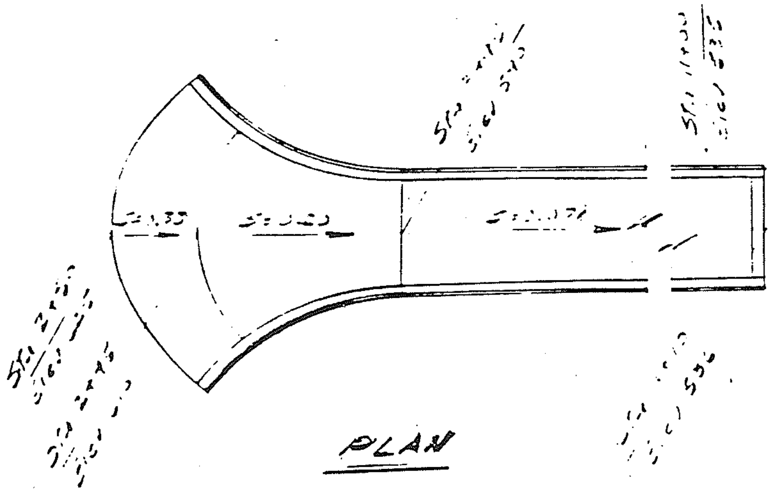
Name of Dam Leroy Anderson Type of Dam Earth & Rock Dam No. 72-9

County Santa Clara Hazard Class 4 Total Class Wt. 30+

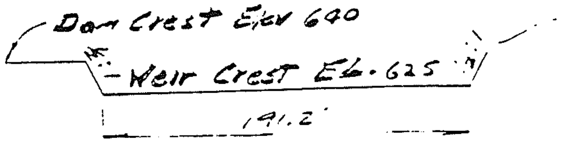
Located on Coyote Creek Tributary to

I. DRAINAGE BASIN		II. DAM AND RESERVOIR	
1. Drainage Area - Sq. Mi.	194.3	1. Reservoir Area @ S/W-Ac	980
2. Impaired?	Yes	2. Res. Capac. to S/W-AF	91300
3. Mean Elevation	1500	3. Surcharge Storage - AF	2008.
4. Mean Latitude	37.15°	4. Spillway Crest Elev.	625
5. Mean Longitude	121.5°	5. Dam Crest Elevation	640
6. Annual Precip. - In.	20.	6. Total Freeboard	15
Elevation Index	1.14	7. Max. Storage Level	625
8. Cover Factor, C	2	8. Gated?	No
		9. Spillway Rating Q = $CLH^{1.5}$	=4221
		$(3.8)(191.2)(15)^{1.5}$	C = 3.8

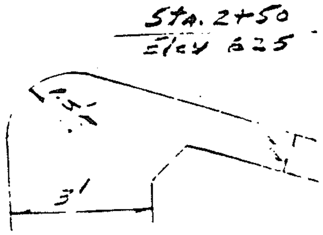
Sketch of Spillway, as per Plans Date [illegible]



PLAN



WEIR SECTION



CREST DETAIL

DS 6/26/80

Calculated by D. 4 Smith Date [illegible] Approved by JAF Project Engineer Date 8/12

DWR 852 (Rev. 3/77)

Page 1 of 3

		Leroy Anderson Dam			Coyote Dam	
	FLOOD HYDROLOGY	HMR 36	80% HMR 36 1/		HMR 36	
1.	Flood Type	PMF	PMF		PMF	
2.	Storm Precip.-In.	24.01	24.01		24.01	
3a.	Precip. Dur.-Hr.	72	72		72	
b.	K(J) Std. Dev.	N/A	N/A		N/A	
c.	Risk Level	N/A	N/A		N/A	
4.	Peak Inflow-cfs	60,224	47,893		43,905	
5.	Peak Inflow-csm	310	246		367	
6.	Runoff - AF	199,067 ✓	199,067		122,534	
7.	Runoff - In.	19.21	19.21		19.21	
8.	Runoff Coeff.	80%	80%		80%	
9.	Div. Inflow-cfs	Impaired	Impaired		-	
10.	Routed?	yes	yes		yes	
11.	Peak Outflow-cfs	57,442	41,202		40,837	
12.	Peak Outflow-csm	296	212		341	
13.	Freeboard _ Feet	overtops 2.5 feet	0.2		4.0	
14.	Max. Res. Stage	642.5	639.8		798	
15.	Max.Spill.Cap.-cfs	42,200	42,200		61,000	
16.	Max.Spill.Cap.-csm	217	217		509	
17.	TC - Hr.	*	*		10.59	
18.	R/TC	*	*		0.99	
19a.	BASEL	0.15	0.15		0.15	
b.	Loss Rate	--	-		-	
20.	Check Adopted Flood	✓	✓		✓	

REMARKS: *	TC	R/TC	Area
Coyote	10.58	0.99	119.8
Anderson Area 1	1.86	0.32	45.3
Area 2	1.68	0.33	29.2

1/ Initial reservoir level is 56 feet below the spillway crest which is the normal Fall storage level and in accordance with the U.S.C.E. Recommended Guidelines, Reference 1.

5.5 Evaluation

The capacity of the spillway at Leroy Anderson Dam is not adequate to pass the PMF. The PMF would overtop the dam for a total of 24 hours by a maximum of 2½ feet. Overtopping of the earth and rock dam embankment, up to a maximum of 2½ feet, would probably cause extensive damage and possibly complete failure.

Assuming the reservoir level is 56 feet below the spillway crest (the normal Fall storage level) at the start of the storm, the spillway will pass slightly over 80 percent of the PMF with zero freeboard.

Since the need for additional spillway capacity is apparent, further study of the questionable flow characteristics of the existing spillway channel is not necessary at this time.

By a letter dated January 15, 1981, the DSOD directed the owner to submit by June 30, 1981, a detailed hydrologic and hydraulic analysis of the performance of the dam under PMF conditions. The DSOD indicated that alterations to the structure or modifications in the operation of the dam and reservoir may be required, depending on the results.

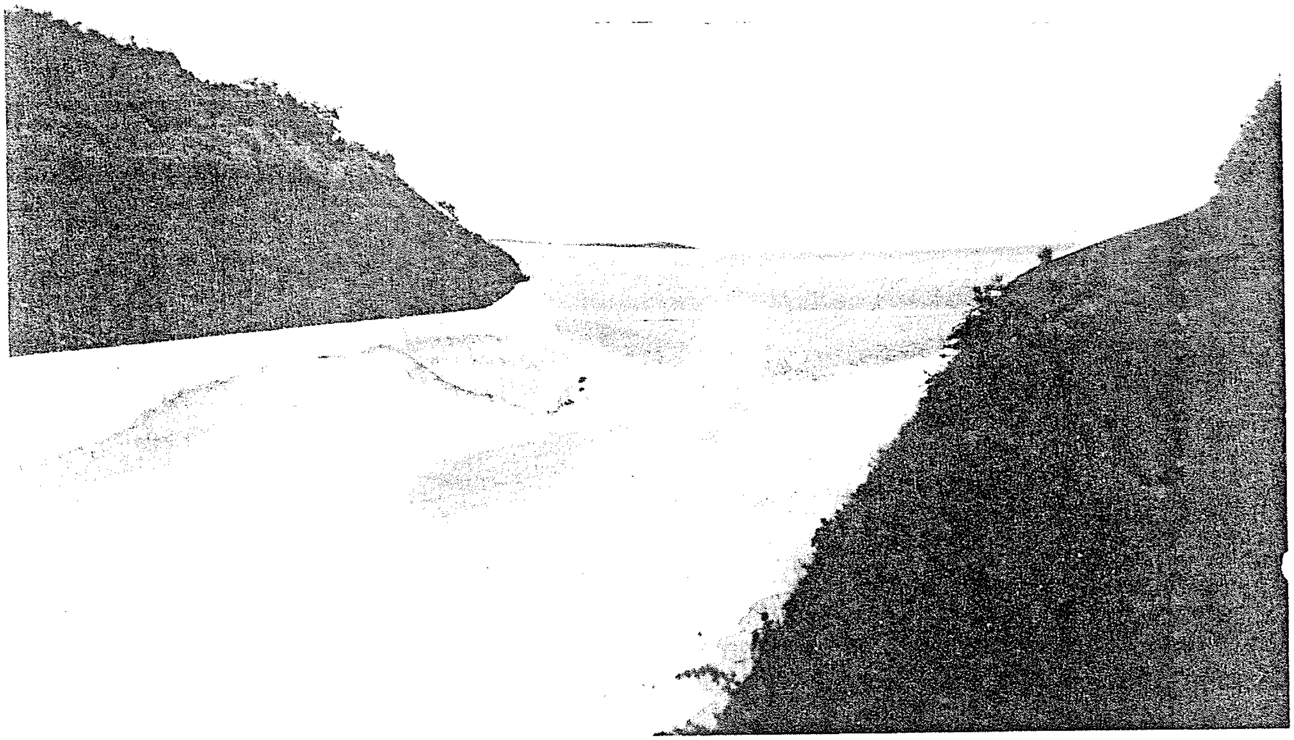


Photo No. 5.1

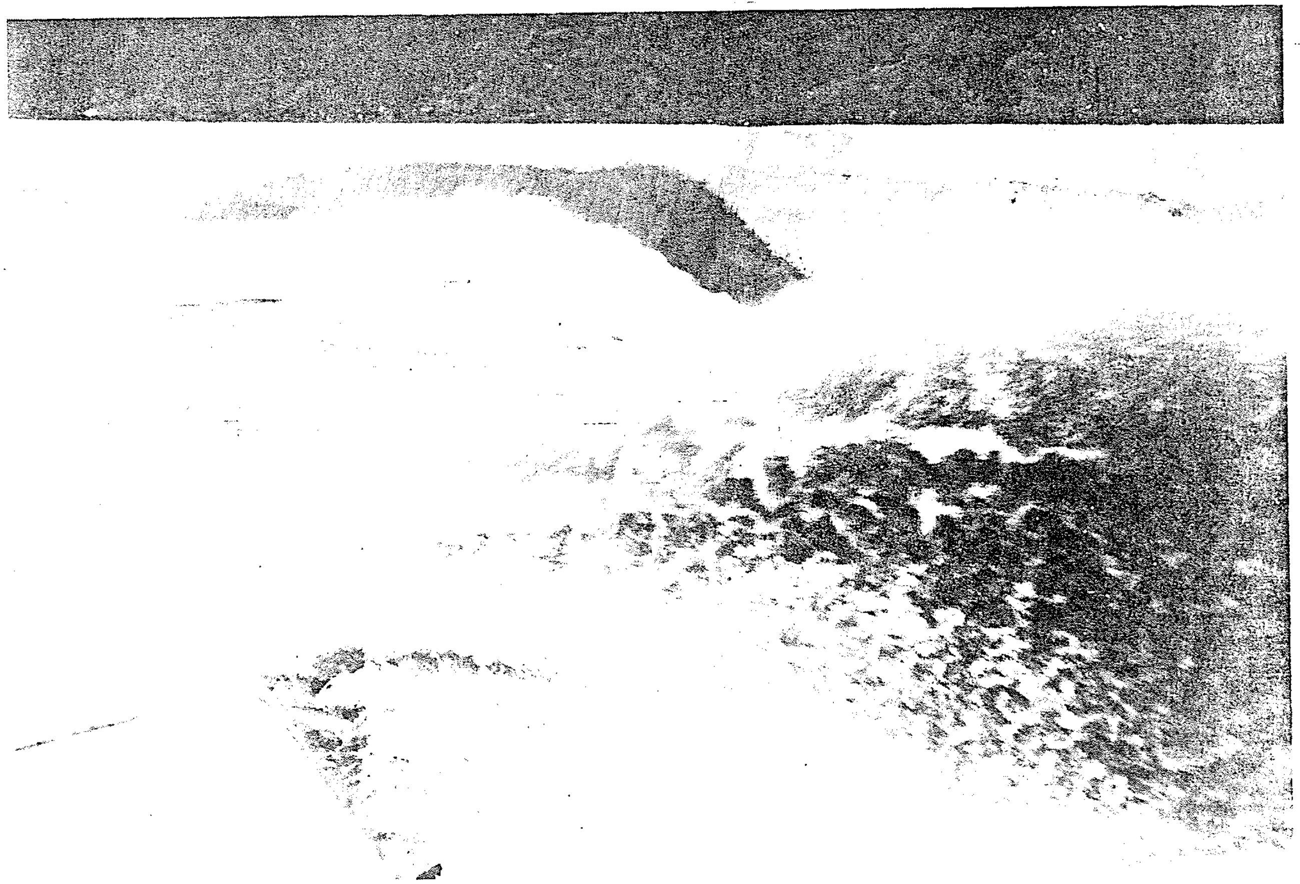


Photo No. 5.2

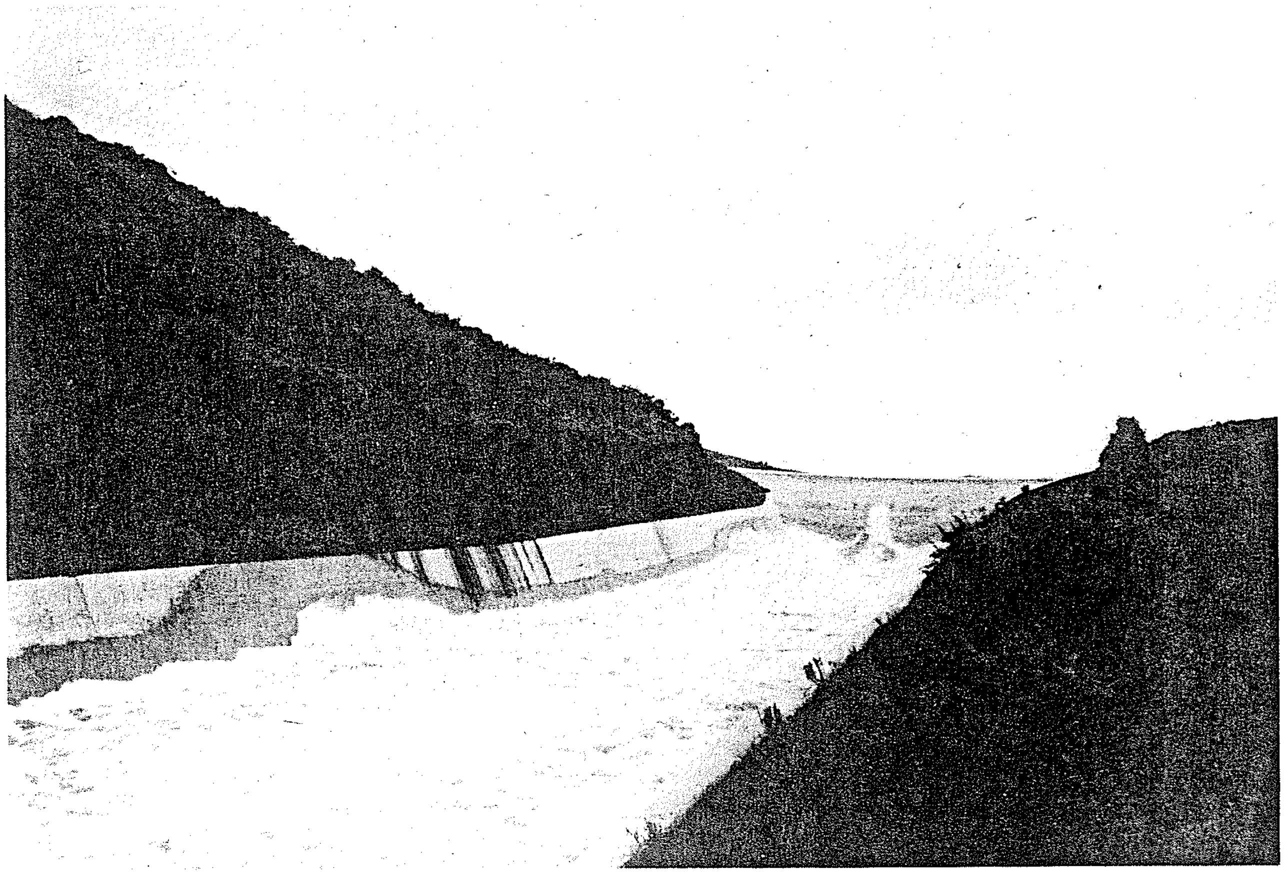


Photo No. 5.3

Photo Nos. 5.1, 5.2, and 5.3 illustrate the flow characteristics due to the rapid convergence below the weir section. Discharge was about 5,000 cfs with the reservoir level 3.1 feet above the spillway crest.

6. FINDINGS

6.1 General

Leroy Anderson Dam was designed and constructed to modern standards and by acceptable methods. In 1975 SCVWD retained a consulting engineering firm, W. A. Wahler and Associates, to evaluate the stability and performance of the dam if subjected to major earthquake loading. The results of that study showed the dam to be stable for all assumed loading conditions.

Performance of the dam during its 30 years of service has been satisfactory, as determined from regular surveillance and instrumentation records. A Certificate of Approval issued by DSOD on May 4, 1966, authorized storage in the reservoir to Elevation 625, U.S.C. & G.S. datum, the spillway crest.

6.2 Planning and Site Investigation

During the planning stages for Leroy Anderson Dam, Consulting Geologist Chester Mariliave investigated the site and prepared a report entitled "Geological Report on the Anderson Dam Site Located Across Coyote Creek in Santa Clara County, California", (Reference 7). He concluded that the site was topographically and geologically good for construction of a high (240 feet) embankment dam.

The site was inspected by DSOD Engineers, G. F. Engle, W. A. Brown, and W. A. Perkins on August 15, 1949. The conclusion from that site inspection was that a safe dam could be constructed at the site.

6.3 Design

Leroy Anderson Dam was designed by the Santa Clara Valley Water Conservation District under the direction of Mr. G. W. Hunt, Chief Engineer of the District. The design was reviewed by the State Division of Water Resources and approved by the State Engineer.

The embankment design included four zones. Zone 1 (upstream pervious shell) was specified to be constructed of rock and boulders consolidated by sluicing with two volumes of water for each volume of fill material. Zones 2 and 3 (impervious core) were specified to be constructed of clay loams and gravelly-clay loams. Zone 2 was intended to be the most highly imperious and within the upstream section of the core. Zone 4 (downstream pervious shell) was specified to be constructed of rock compacted by moisture conditioning and rolling.

The exterior slopes of the embankment section were revised from the original plan of 2H:1V with 80 foot benches at about 2/3 of the total height, to slopes of 2½H:1V both upstream and downstream. The final as-constructed embankment section is described in Section 2.5.

A stability analysis of the as-constructed embankment section was made by DSOD in 1951. This analysis utilized the conventional method of circular arc failure surfaces and soil properties as follows:

Zone	Unit Weight (pcf) Moist	Unit Weight (pcf) Saturated	Ø (Degrees)	Cohesion (psf)
Upstream shell	110	132	35	0
Core	120	130	17	2000
Downstream Shell	105	-	35	0

For the condition of a full reservoir and pseudo-static loading of 0.1g, the computed factors of safety were 1.27 for the upstream slope and 1.16 for the downstream slope. Results of a recent investigation of seismic stability, completed in 1977, are described in Section 6.7.

6.4 Construction

Bids for construction of the dam were opened on March 7, 1950, and a contract was awarded to Guy F. Atkinson Company. The outlet was constructed prior to this time during the Fall of 1949.

The Santa Clara Valley Water Conservation District maintained construction control and inspections with their own personnel. DSOD engineers made frequent inspections during construction; and during a major portion of the construction had a resident inspector continuously at the site.

Excavation for the foundation uncovered poor quality serpentine rock on the right abutment. Mr. J. L. Savage, Consulting Engineer, and Dr. George Louderback, Consulting Geologist, were retained to study and evaluate the questionable stability of the right abutment due to the serpentine formation. Their study included exploratory drilling throughout the questionable formation which was determined to be "serpentinized sandstone". From this exploration, the consultants concluded that grouting to provide a curtain cutoff could not be satisfactorily accomplished within the serpentinized sandstone. However, it was determined that the structural bedding had a favorable attitude by striking diagonally downstream across the channel, and the cracks in the fractured rock were small; therefore, the expected seepage would be small. Final treatment for the serpentinized sandstone on the right abutment was not determined until stripping was complete. A deep cut was made through the serpentine to lengthen the seepage path through this formation and possibly effectively reduce the extent of future saturation in the serpentine downstream of the dam axis. Additional excavation upstream of the dam on the right abutment was also made to flatten the slope and stabilize the slope below the spillway entrance. Satisfactory performance since construction indicates that the treatment on the right abutment was adequate. No other major problems were encountered during construction.

The specifications called for compaction of uniformly moisture conditioned lifts of the core zones with about 10 passes of a tamping roller weighing 3,300 pounds per foot of roller width. The lift thickness after compaction was not to exceed 4 inches. Additional control was provided by taking 469 relative compaction tests during construction. Where these tests showed the compaction inadequate, or the moisture too high or low, the material was reworked and retested. The records indicate construction control was adequate.

Concrete for the outlet encasement and the spillway lining was specified to be Class A concrete according to the then current Standard Specifications for the California Department of Public Works, Division of Highways.

Construction of Leroy Anderson Dam was completed on January 4, 1951, approximately 10 months after the contract was awarded.

6.5 Operations and Maintenance, Modifications, and Past Events

The main purposes of the reservoir are for ground water recharge and for irrigation. All storage is produced from natural runoff. Storage is released through the outlet to meet demands for irrigation and to supply the three ground water recharge facilities.

The upstream outlet valve is normally in the full open position, and releases are controlled by the downstream butterfly valve. The upstream valve is cycled through the closed position to full open as a part of the owners annual maintainence.

Leroy Anderson Dam is well maintained. Recent inspections have not detected problems detrimental to the safety of the dam.

In April 1952, during an inspection by DSOD, an extensive seepage area was observed on the right abutment ridge below the low spur fill running to the spillway. There were several small concentrated flows within the general seepage area and the total flow was roughly estimated to be 20 gallons per minute (gpm). Seepage was also observed from the weep holes in the concrete spillway lining.

The above described seepage area was observed closely during periods of high reservoir stages; and in September 1959 a drain was installed. The drain consisted of a trench along the upper limits of the seepage area backfilled with drain gravel. A perforated corrugated metal pipe was placed within the drain rock. Two outfalls were provided which discharge into the spillway channel. Subsequently, during periods of high reservoir stage, the drain outfalls flowed; and there was only minor surface seepage appearing on this ridge.

In November 1960, the reservoir was drained and a section was added to the outlet intake raising the structure 8 feet, 8 inches. When the reservoir was empty, it was noted that siltation was minor. There was not any apparent threat that the outlet intake would become plugged.

In 1962, a minor slide occurred on the left abutment about 300 feet upstream from the dam. This slide was observed frequently and continued to move slowly for almost two years until the owner physically removed much of the sliding material. There were no indications of further movement in this slide area until 1969 (five years later) when cracks appeared and some movement was detected. Further regrading at that time stabilized the slide and no movement has been detected since.

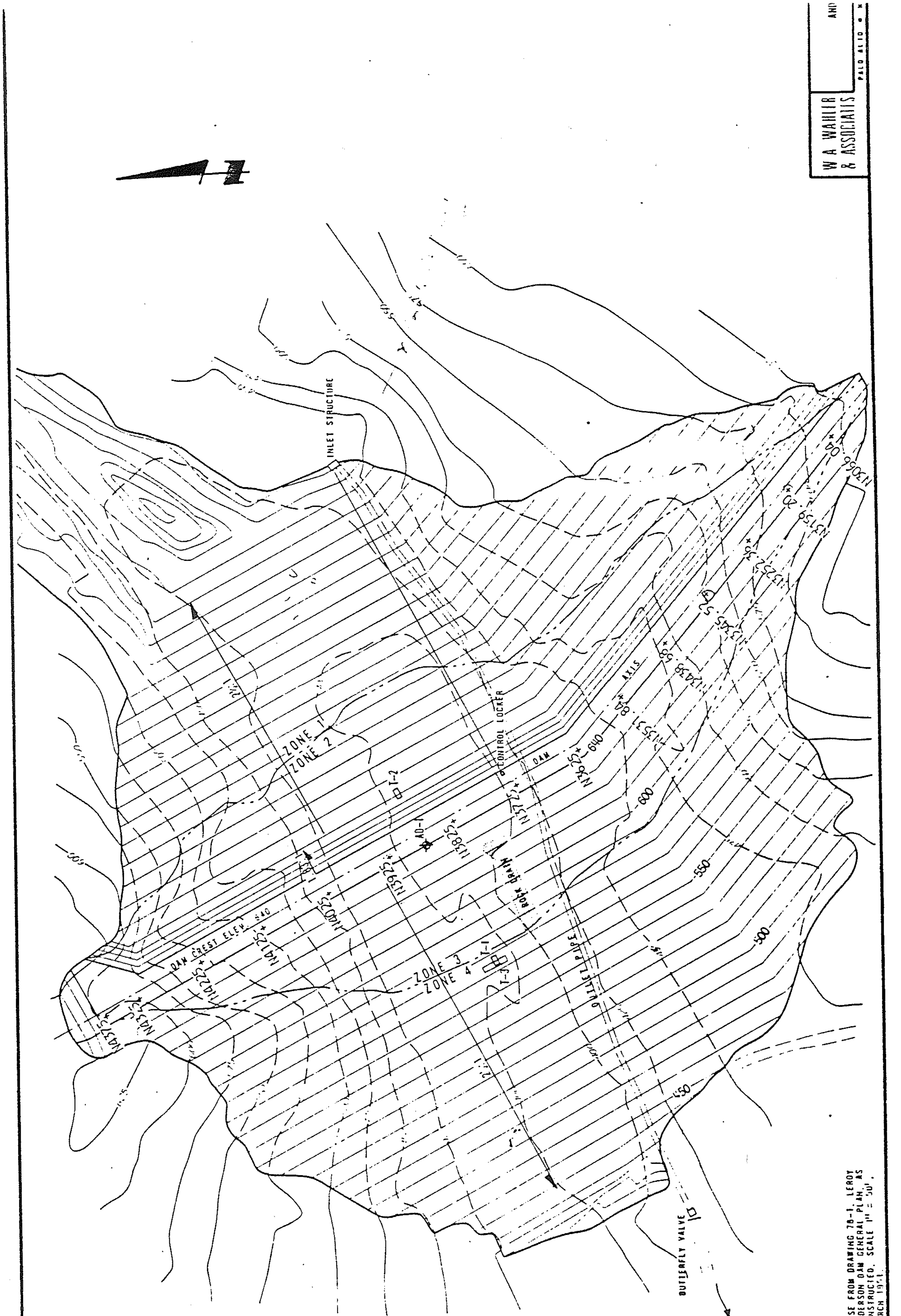
6.6 Instrumentation

Instrumentation on Leroy Anderson Dam on which regular readings are obtained and analyzed consists of 15 monuments on the dam crest and 2 piezometers within the maximum section of the embankment. There are also staff gages on the upstream slope of the embankment for monitoring the reservoir surface level. The 15 monuments are evenly spaced across the crest of the dam and were installed shortly after construction was completed. The two piezometers were installed in Drill Hole AD-1 at depths of 100 and 200 feet during the investigation for a stability evaluation conducted by W. A. Wahler and Associates, Engineers and Consultants, in 1975 and 1976. The location of the monuments and Drill Hole AD-1 are shown on Plate 6-1.

Surveys to determine vertical and horizontal movement of the 15 monuments were performed intermittently between 1951 and 1964. Since 1964 these surveys have been performed regularly on a semiannual basis and submitted to DSOD annually.

Records of the settlement show normal expected amounts for an embankment dam. Initially, after construction, the rate was highest. From 5 to 14 years later, depending on the depth of embankment, settlement decreased to a negligible amount. The approximate height of embankment beneath each monument, the maximum settlement for each monument, and the settlement measured as a percent of embankment height are tabulated on the following page.

SETTLEMENT MONUMENT	Appromimate Height of Embankment (ft)	Total Settlement as of 7/80 (ft)	Settlement as Percent of Embankment Height (%)
N 3066.04	20	-0.06 (rise)	-0.30
N 3159.20	50	0.17	0.34
N 3252.36	70	0.54	0.77
N 3345.52	113	0.98	0.87
N 3438.68	153	1.84	1.20
N 3531.84	180	2.33	1.29
N 3625	202	2.65	1.31
N 3725	228	3.05	1.34
N 3825	242	3.26	1.35
N 3925	238	3.25	1.36
N 4025	205	2.91	1.42
N 4125	150	2.22	1.48
N 4225	113	1.30	1.15
N 4324.96	40	0.44	1.10
N 4375	27	0.22	0.81



Instrumentation on Leroy Anderson Dam

PLATE 6-1

Records of the lateral movement for the same 15 monuments show the entire crest of the dam moved in an upstream direction following the initial filling of the reservoir. This movement varied between 0.04 foot and 0.23 foot for embankment heights of 50 feet and 238 feet respectively. Subsequent to the initial movement the lateral movement varied depending on the location of the crest. Lateral movement near the maximum section was primarily in the downstream direction during the first 8 years. Later that movement reversed to the upstream direction. Other lateral movement was generally in the upstream direction from the time the surveys were initiated. The approximate height of embankment at each monument, the maximum lateral movement, the relative position between the time of installation and that of the last reported survey are tabulated below.

MONUMENT	Approximate Height of Embankment (ft)	*Maximum Lateral Movement (ft)	*Relative Position as of 7/80 (ft)
N 3066.04	20		-0.01
N 3159.20	50	+ 0.24	+ 0.20
N 3252.36	70		+ 0.45
N 3345.52	113	+ 0.61	+ 0.59
N 3438.68	153		+ 0.41
N 3531.84	180	+ 0.48	+ 0.32
N 3625	202		+ 0.14
N 3725	228	-0.06 to + 0.22	+ 0.06
N 3825	242		+ 0.05
N 3925	238	-0.14 to + 0.20	+ 0.05
N 4025	205		+ 0.14
N 4125	150		+ 0.18
N 4225	113		+ 0.23
N 4324.96	40		+ 0.17
N 4375	27		+ 0.08

*Lateral Deflection: + is upstream
- is downstream

The settlement and lateral movement record indicate major movements, following the construction of Leroy Anderson Dam, have ceased. No unusual or abrupt movements were noted. All indications are that the embankment is performing satisfactorily.

Initial readings taken from Piezometers PPA-1 and PPA-2 indicated only that the core is impervious. Records of those readings and the reservoir water level follow.

Piezometer No.	Location (Drill Hole)	Piezometer Depth (ft)	Piezometer Elevation
PPA-1	Crest (AD-1)	100.0	540
PPA-2	Crest (AD-1)	200.0	440

Date of Reading	Reservoir Elevation	Pneumatic Piezometers PPA-1 (psi)	PPA-1 (feet)	PPA-2 (psi)	PPA-2 (feet)
12/3/75	602.06	14.2	32.8	26.4	61.0
12/19/75	601.07	13.8	31.9	26.5	61.2
1/5/76	600.75	13.4	31.0	26.3	60.8
1/15/76	601.12	13.4	31.0	26.5	61.2
2/2/76	601.50	13.4	30.9	26.5	61.2
2/23/76	600.03	13.5	31.2	26.3	60.7
3/22/76	598.37	13.0	30.0	26.1	60.2
4/20/76	596.22	13.0	30.0	26.1	60.2
5/17/76	592.40	13.0	30.0	26.2	60.5
6/15/76	586.40	10.8	24.9	25.0	57.7
7/15/76	579.12	10.8	24.9	25.0	57.7

Recent piezometer readings by the SCVWD have been forwarded to DSOD without details about sensing zones and reference elevations necessary for an engineering evaluation of the data. By letter of November 5, 1980, DSOD asked SCVWD to furnish a descriptive narrative and details needed to evaluate the raw data submitted. Continued monitoring of the two piezometers, along with engineering analysis of the data, should remain a part of the owner's surveillance; and they were so advised by the above referenced letter. Future submittals of the piezometer and reservoir water level data to DSOD are to be annually.

6.7 Recent Investigations, Seismic Stability

The Santa Clara Valley Water District retained the engineering firm of W. A. Wahler and Associates in 1975 to evaluate the stability and performance of Leroy Anderson Dam (Reference 8). Wahler concluded that safety factors with earthquake loading of 0.2g were within acceptable limits.

Their investigation included a review of pertinent records, an inspection of the dam and appurtenances, research on the regional and site geology, a subsurface investigation including trenches in the shell material and drilling and logging in the impervious core, installation and monitoring of piezometers within the dam, laboratory testing of embankment materials, and a conventional stability analysis for static and earthquake loadings.

Faults considered for determination of earthquake loading were:

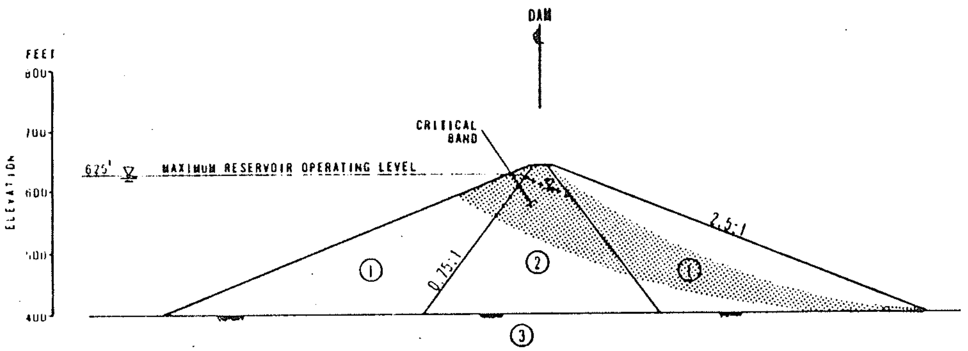
Fault	Distance from dam	Magnitude of Earthquake
Calaveras	1.6 km	7.5
San Andreas	21 km	8.5
Hayward	13 km	7.5
*Coyote Creek	0	6.0
Silver Creek	1 km	6.0

*Coyote Creek Fault underlies a portion of the dam on the right abutment.

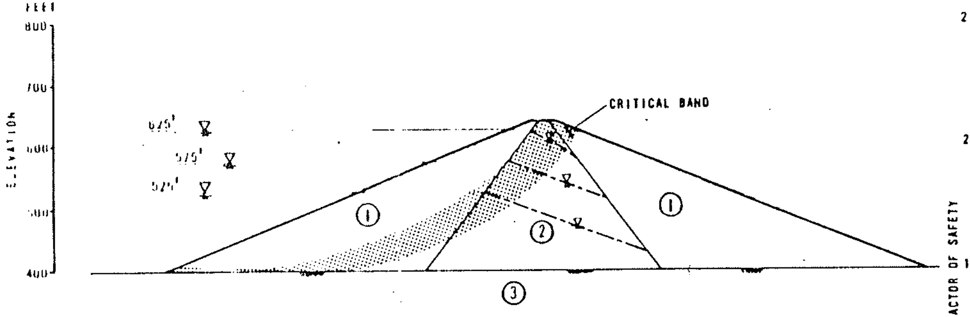
No dynamic tests were performed on the embankment materials. Comparisons were made with dynamic tests conducted on similar impervious material in Coyote Dam. No sudden loss of strength occurred during any of the dynamic testing at Coyote Dam. From the comparison of similar impervious material tested, and due to the character of the pervious shells, W. A. Wahler concluded that liquefaction was not to be considered as a mode of failure during earthquake loading. The large rock contained in the shell zones made testing of this material impractical.

Undisturbed thin-wall tube samples were obtained from the exploratory drilling for testing of the impervious core material. Unconsolidated-undrained triaxial shear and consolidated-undrained triaxial shear tests were conducted to determine the strength of this material. Results of the triaxial testing are contained in Appendix D.

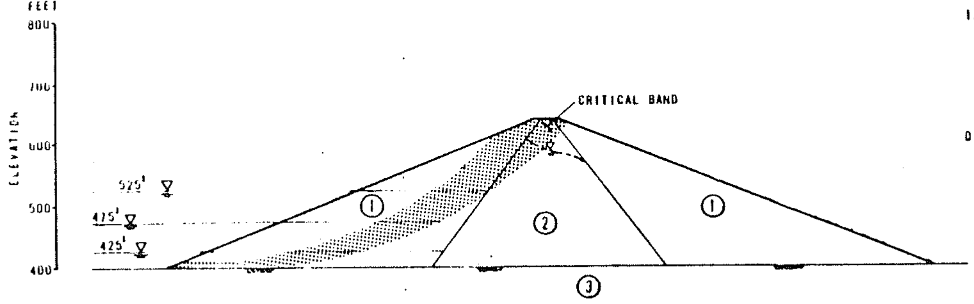
The shear strength parameters are shown on Plate 6-1 along with the results of Wahler's stability analysis. Wahler concluded that the stability of Anderson Dam, based on the computed factors of safety, is acceptable according to dam design standards. The computed safety factors were 1.8 and



A. CASE 1 - DOWNSTREAM SLOPE
(STEADY STATE SEEPAGE)

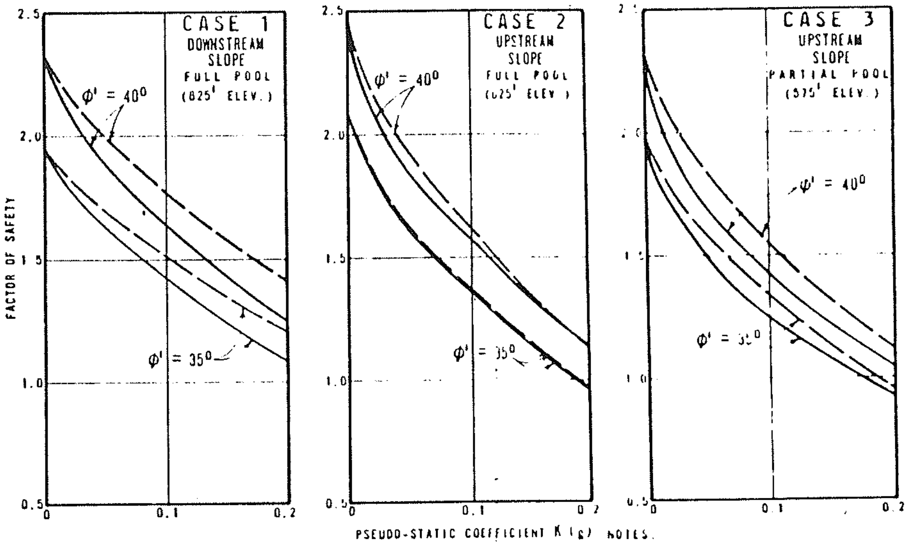


B. CASES 2, 3 & 4 - UPSTREAM SLOPE
(STEADY STATE SEEPAGE)



C. CASES 5, 6 & 7 - UPSTREAM SLOPE
(RAPID DRAWDOWN)

ZONE NO.	EMBANKMENT LOCATION	MATERIAL TYPE	MATERIALS PROPERTIES SHEAR STRENGTH PARAMETERS EFFECTIVE ϕ' (DEGREES)	 C' (psf)	 TOTAL ϕ (DEGREES)	 C (psf)	TOTAL UNIT WEIGHT (pcf)
①	SHELL	ROCKFILL	35-40	250	----	----	140
②	CORE	SANDY CLAY	28	800	17	800	130
③	FOUNDATION	BEDROCK	0	20,000	----	----	150



KEY
— — Effective Stress
—— Total Stress

SCALE
200 0 200 FEET

NOTES.
(1) DETAILED SUMMARY OF RESULTS CAN BE FOUND IN TABLE V-1.
(2) RANGE OF STRENGTH PARAMETERS SHOWN ON FIGURES IS FOR THE FRICTIONAL COMPONENT OF THE SHELL MATERIAL.

W. A. WAHLER & ASSOCIATES
PALO ALTO • NEWPORT BEACH • CALIF.

ANDERSON DAM

STABILITY ANALYSES

[illegible]	[illegible]	[illegible]
D746A	SEPTEMBER 1976	V-2

2.0 respectively for the upstream and downstream slopes for static loading conditions. Wahler also concluded that safety factors with earthquake loading of 0.2g were within acceptable limits. The following conclusions regarding performance during a major earthquake are quoted from the W. A. Wahler report:

> "1) permanent distortions may occur, primarily as a result of settlements within the upstream and downstream shells, but these distortions should be minor and the integrity of the dam would be maintained;
>
> 2) if ground rupture were to occur within the right abutment area, the plastic deformation characteristics of the core material and the reported character of the transition material between the rockfill and core should provide adequate protection of the core; and
>
> 3) ground offset could also cause damage to the spillway; however, such damage would only pose a threat to the overall integrity of the dam in the extremely unlikely event (from a probabilistic standpoint) of a major earthquake occurring simultaneously with spillway discharge."

Separate analyses by DSOD (References 9 and 10 included in Appendix G) verified the conclusions in the W. A. Wahler report that Leroy Anderson Dam would perform satisfactory during a Maximum Credible Earthquake.

6.8 Evaluation

The design and construction of Leroy Anderson Dam were according to modern standards and acceptable methods. Recent stability analyses showed the dam to be stable for all assumed loading conditions including earthquake loading of 0.2g.

Maintenance of the dam, spillway and outlet is satisfactory.

Surveillance and instrumentation is adequate; however, additional details necessary for interpretation of the piezometer data should be furnished by the SCVWD.

The overall performance of Leroy Anderson Dam has been satisfactory during its 30 years of operation.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

Leroy Anderson Dam was designed and constructed according to modern standards and acceptable methods. Performance of the dam during its 30 years of service has been satisfactory.

7.2 Adequacy of Records

Records for Leroy Anderson Dam and Reservoir in the DSOD files are quite complete and adequate. They include geologic investigations made prior to and following construction, consultants reports, design studies, construction records, and reports of operational evaluations. The available records are adequate for this Phase I evaluation.

7.3 Adequacy of Structures

a. Foundation

All overburden materials and soft serpentine were removed during construction. The resulting foundation of firm sandstone, shale, volcanics, and serpentine is satisfactory for the embankment dam.

b. Stability

Recent stability analyses show the dam to be stable for all loading conditions including an earthquake loading of 0.2g.

Slide conditions around the perimeter of the reservoir do not pose a significant threat to the safety of the dam or appurtenances.

c. Surveillance

Surveillance and instrumentation are adequate; however, additional details needed to permit interpretation of the piezometer data were requested of SCVWD by DSOD in a letter of November 5, 1980.

d. Spillway

Rapid convergence conditions in the spillway channel below the weir section make flow conditions unstable.

The spillway capacity is inadequate. The PMF will overtop the embankment dam up to a maximum of 2½ feet.

7.4 Recommendations

1. Necessary information to allow interpretation of the piezometer readings should be obtained from the SCVWD. This information was requested from the SCVWD by DSOD in a letter of November 5, 1980.

2. By letter dated, January 15, 1981, the DSOD directed the owner to make a detailed hydrologic and hydraulic analysis of the performance of the dam under PMF conditions, and to submit their results for review by June 30, 1981. The DSOD also stated that alterations to the structure or modifications in the operation of the dam and reservoir may be required.

7.5 Necessity for Further Investigation

Existing stability studies show acceptable safety factors for Leroy Anderson Dam. Further in-depth studies are not considered necessary for a safety evaluation, and no additional investigation, other than that for the hydrology and spillway capacity, is recommended at this time.

REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of the Army, Office of the Chief of Engineers.

2. W. A. Wahler & Assoc., Evaluation of Stability and Performance, [Leroy] Anderson Dam, Santa Clara County, April, 1977.

3. Wagner, David L; Armstrong, Charles F.; Saucedo, G. J., Geology of the Diablo Range Study Area II, OFR 78-12-SF, California. Division of Mines & Geology, 1978.

4. Dibblee, Thomas W., Preliminary Geologic Map of Mount Sizer and Morgan Hill Qradrangles, Open File Maps, U. S. Geological Survey, 1973.

5. Hydrometeorological Report No. 36, Interim Report Probable Maximum Precipitation in California, U. S. Weather Bureau.

6. Department of Water Resources, Division of Safety of Dams, Hydrology Manual, Flood Estimates for Dams, Memorandum Report, December 1979, Revised March 1981.

7. Geological Report on Anderson Dam Site Located Across Coyote Creek in Santa Clara County, California, By Chester Marliave, Consulting Geologist, September 15, 1949.

8. Wahler, W. A., and Associates, Anderson Dam-Evaluation of Stability and Performance, April 1977.

9. Memorandum of Design Review, Leroy Anderson Dam, No. 72-9, Static Stability, May 22, 1979, by D. Smith and D. Babbitt.

10. Memorandum of Design Review, Leroy Anderson Dam, No. 72-9, May 29, 1979, By J. L. Vrymoed.

11. Seismic Evaluation of the Coyote Creek Fault, Santa Clara County, November 13, 1979, by Guy L. Hanegan, Files, DSOD.

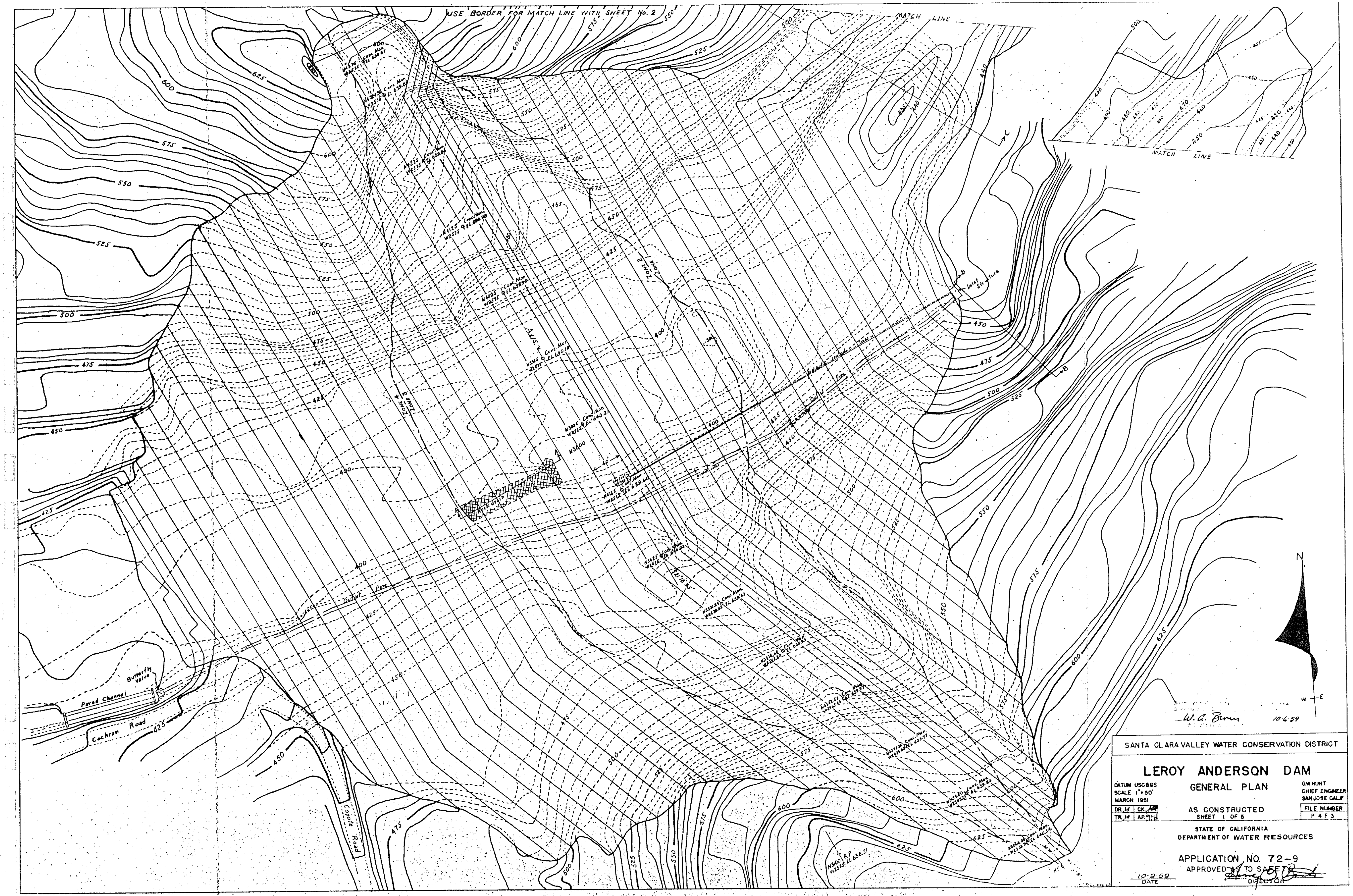
12. Memorandum of Geologic Review, Leroy Anderson Dam, No. 72-9, November 13, 1979, by Guy L. Hanegan, Files, DSOD.

13. Scott, James, Reconnaissance of Landslide Conditions at Anderson Reservoir, Santa Clara Valley Water District, January 1976.

APPENDIX A

Selected Drawings

P4F3, Sheet 1 - General Plan of Dam Embankment
P4F3, Sheet 2 - General Plan of Spillway
P4F3, Sheet 3 - Spillway Profile and Details
P4F3, Sheet 4 - Details of Dam and Outlet Works
P4F3, Sheet 5 - Outlet Works, Inlet and Outlet Structures



W. C. Brown 10-6-59

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

LEROY ANDERSON DAM

GENERAL PLAN

DATUM USC&GS
SCALE 1" = 50'
MARCH 1961

G.W. HUNT
CHIEF ENGINEER
SAN JOSE CALIF

DR. JG	CK.
TR. JH	AP.

AS CONSTRUCTED
SHEET 1 OF 5

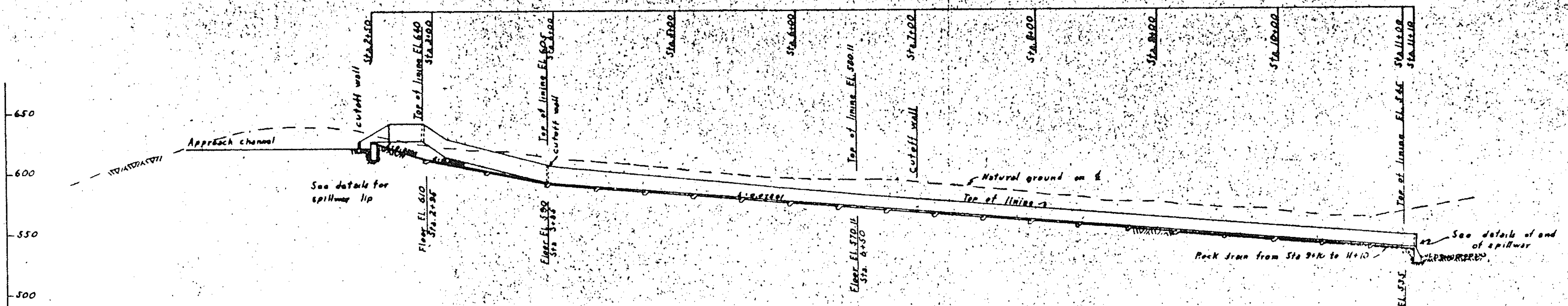
FILE NUMBER
P 4 F 3

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

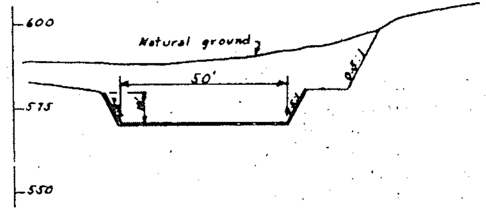
APPLICATION NO. 72-9
APPROVED AS TO SAFETY

10-9-59
DATE

DIRECTOR

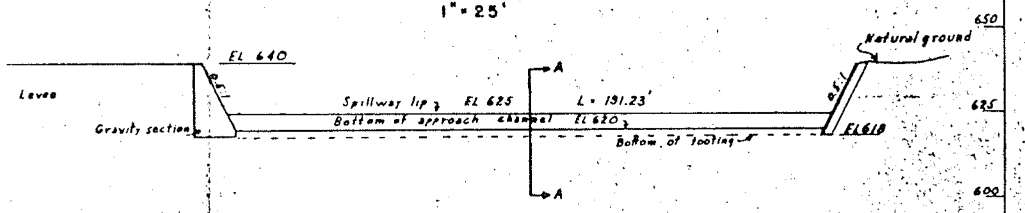


PROFILE ALONG ℄ OF SPILLWAY



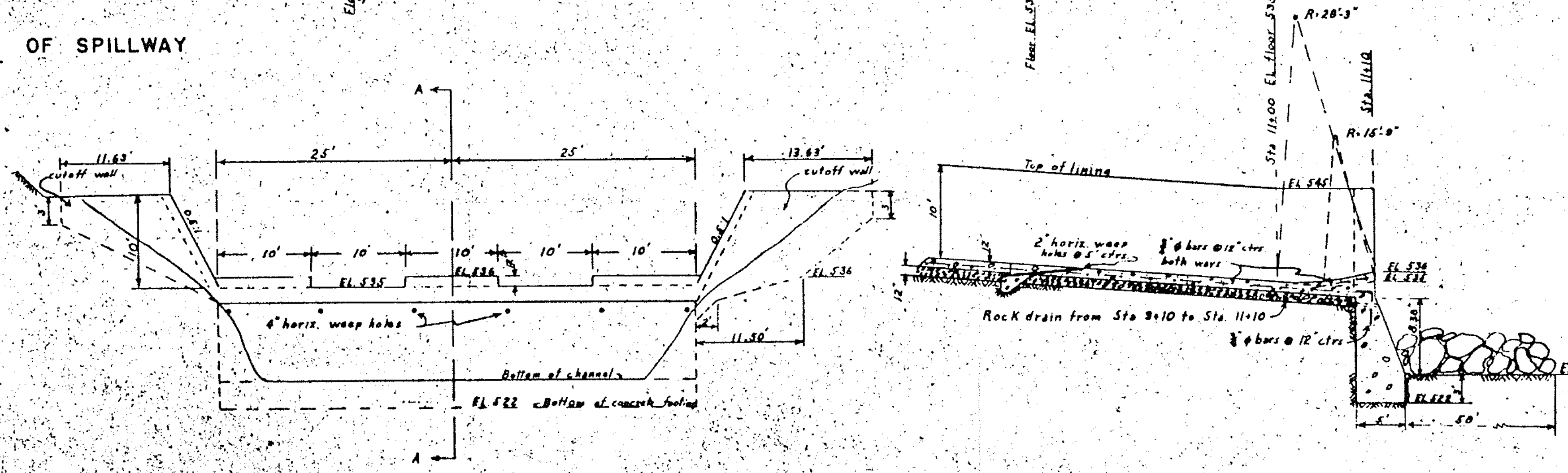
SECTION AT STA. 6+50

1" = 25'



DEVELOPED SECTION AT STA. 2+50

1" = 25'

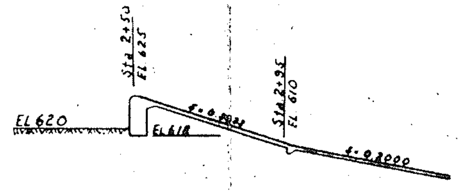


ELEVATION VIEW

SECTION A—A

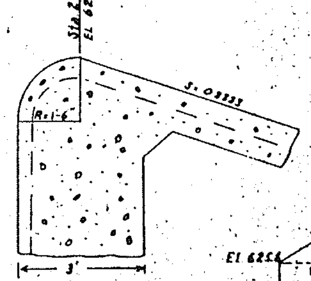
END DETAILS

1/8" = 1'



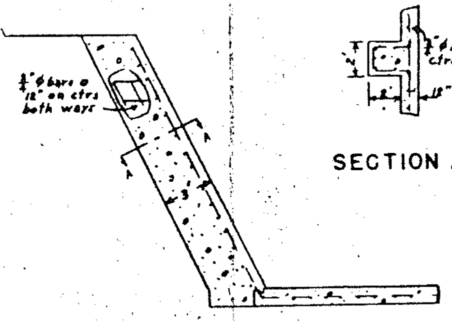
SECTION A—A

1" = 25'

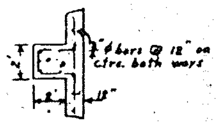


LIP DETAIL

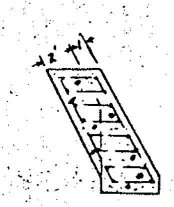
1/2" = 1'



PART SECTION AT CUTOFF



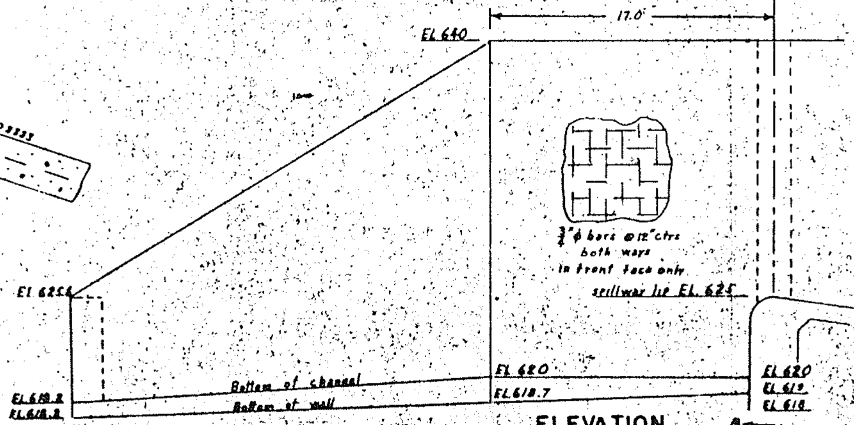
SECTION A—A



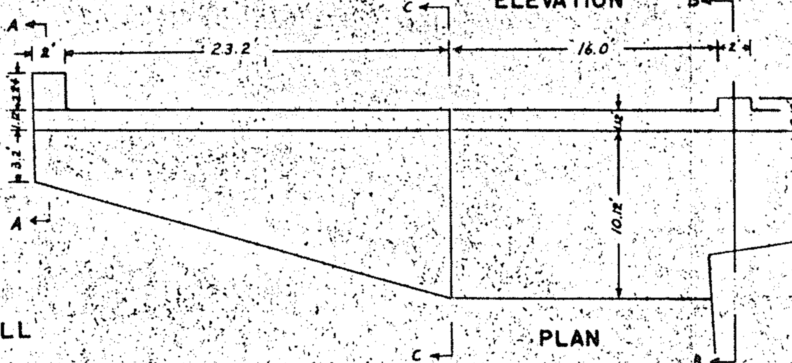
END SECTON A—A THROUGH CUTOFF WALL

CUTOFF WALL DETAILS

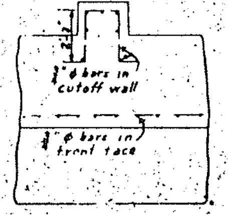
1" = 5'



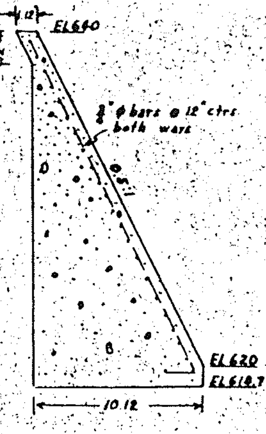
ELEVATION



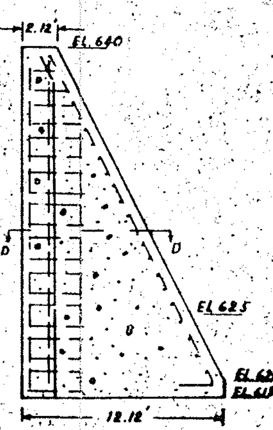
PLAN



SECTION D—D



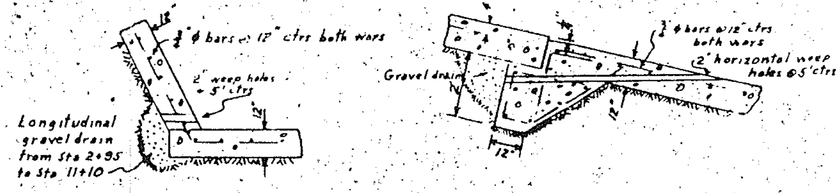
SECTION C—C



SECTION B—B

DETAILS OF GRAVITY SECTION & CUTOFF WALLS

1" = 5'



3/4" ϕ bars @ 12" ctrs both ways
2" weep holes @ 5' ctrs
Longitudinal gravel drain from Sta 2+95 to Sta 11+10
Gravel drain
3/4" ϕ bars @ 12" ctrs both ways
2" horizontal weep holes @ 5' ctrs
12"

LONGITUDINAL JOINT

TRANSVERSE JOINT

JOINT DETAILS

NO SCALE

Recommended for the approval of the
Director of Water Resources as to safety
W. A. Brown 10-6-59
Principal Engineer Date

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

LEROY ANDERSON DAM

DATUM USC&GS
SCALE AS SHOWN
MARCH 1961

SPILLWAY DETAILS

G. W. HUNT
CHIEF ENGINEER
SAN JOSE CALIF

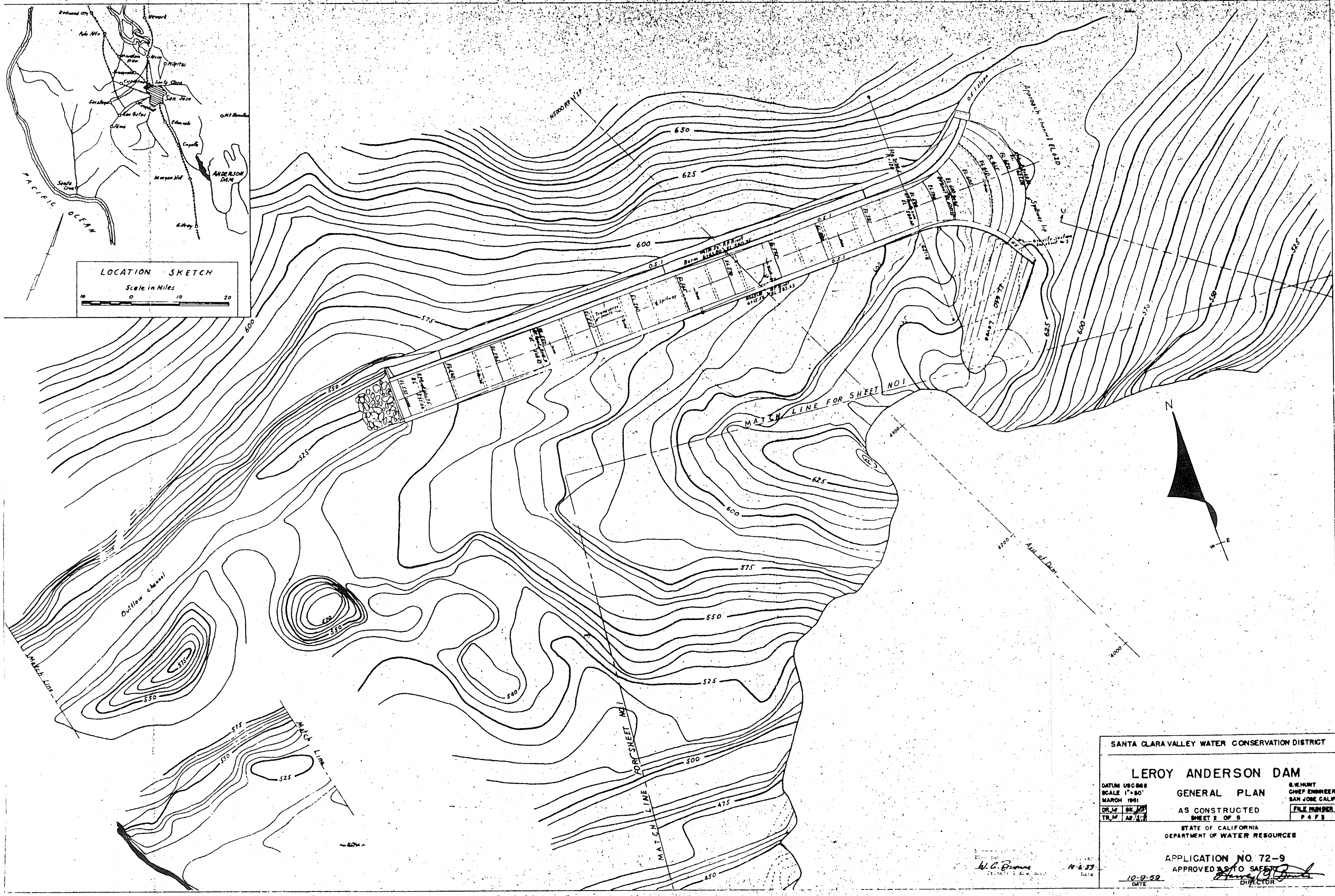
DR. JL | CK.
TR. JW | AR.

AS CONSTRUCTED
SHEET 3 OF 5

FILE NUMBER
P 4 F 3

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

APPLICATION NO. 72—9
APPROVED AS TO SAFETY
10-9-59
DATE
DIRECTOR



SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

LEROY ANDERSON DAM

DATUM USC&GS
SCALE 1" = 50'
MARCH 1951

GENERAL PLAN

AS CONSTRUCTED
SHEET 2 OF 5

G.W. HUNT
CHIEF ENGINEER
SAN JOSE CALIF

DR.	CK.
TR.	AP.

FILE NUMBER
P 4 F 3

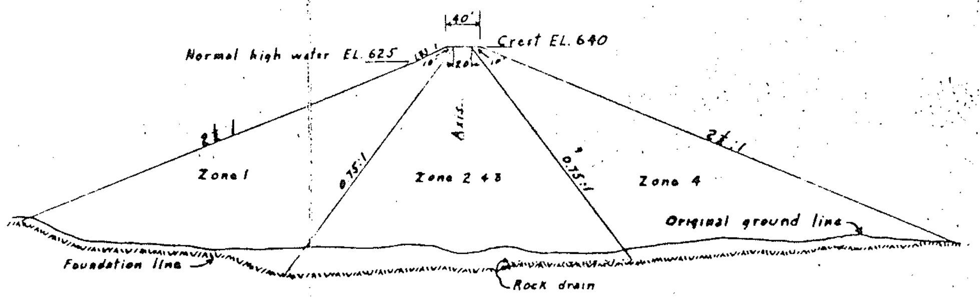
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

APPLICATION NO. 72-9
APPROVED AS TO SAFETY

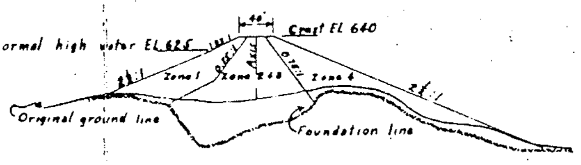
W. C. Brown
10-6-59
Date

10-9-59
DATE

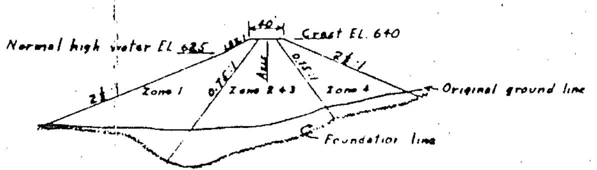
Harvey O. Banks
DIRECTOR



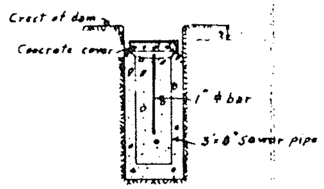
MAXIMUM SECTION STATION 3800
1" = 100'



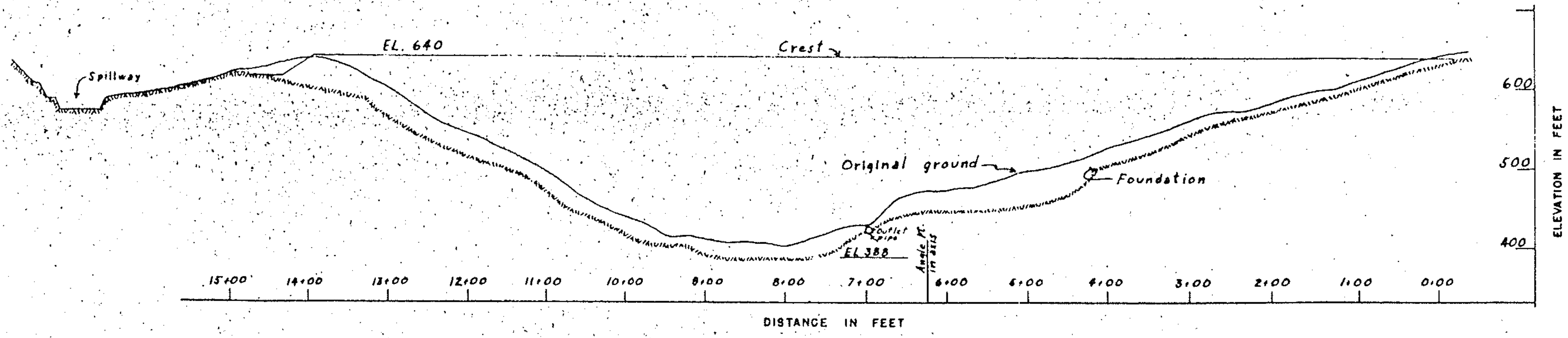
STATION 4250
1" = 100'



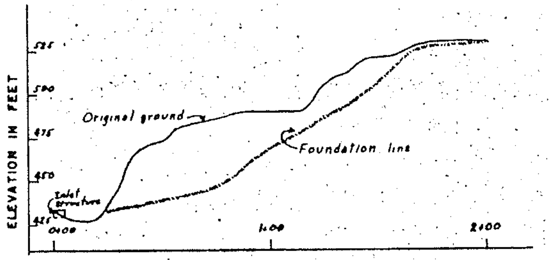
NORMAL SECTION AT STATION 3375
1" = 100'



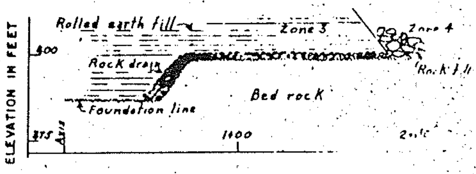
MONUMENT
NO SCALE



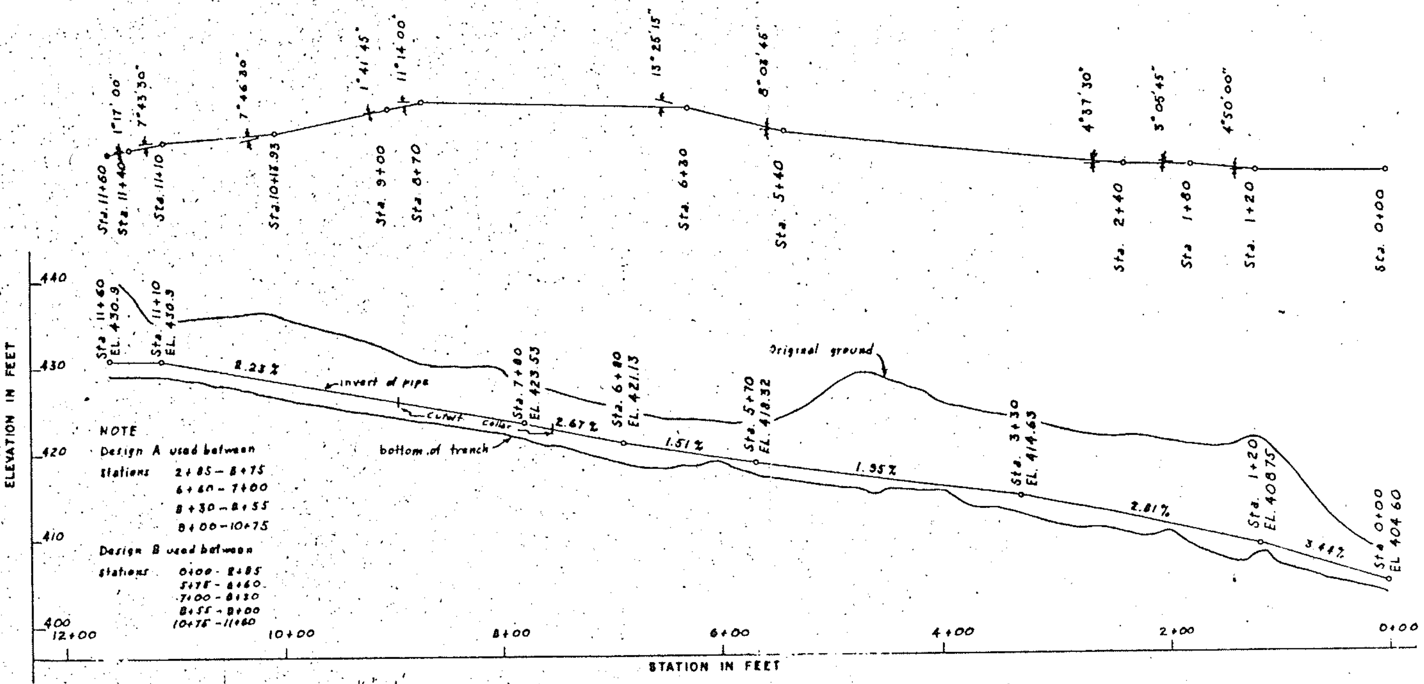
DEVELOPED PROFILE ALONG AXIS
1" = 100'



EXCAVATION ABOVE INLET STRUCTURE
SECTION B-B SHEET NO. 1
1" = 40'



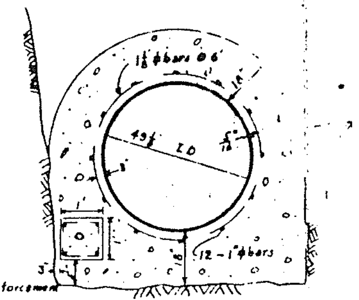
ROCK DRAIN AT STATION 3800
SECTION A-A SHEET NO 1
1" = 50



NOTE
Design A used between
stations 2+85 – 8+75
6+60 – 7+00
8+30 – 8+55
8+00 – 10+75

Design B used between
stations 0+00 – 2+85
5+75 – 6+60
7+00 – 8+30
8+55 – 8+00
10+75 – 11+60

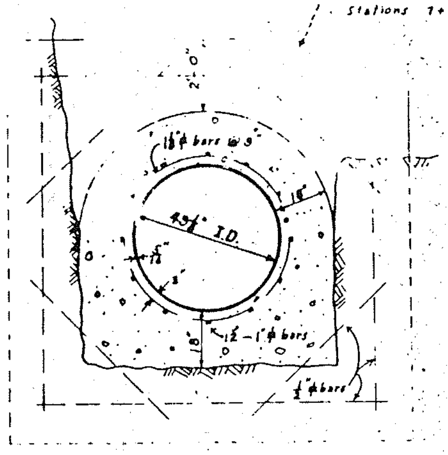
PLAN AND PROFILE OF OUTLET PIPE



NOTE
All splices in reinforcing steel lapped 40 diameters

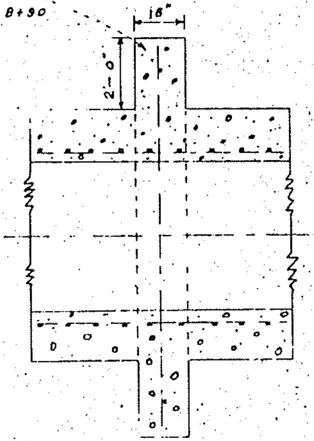
NOTE
Additional reinforcement as shown used on both sides of trench between —
Stations 0+77 — 1+12

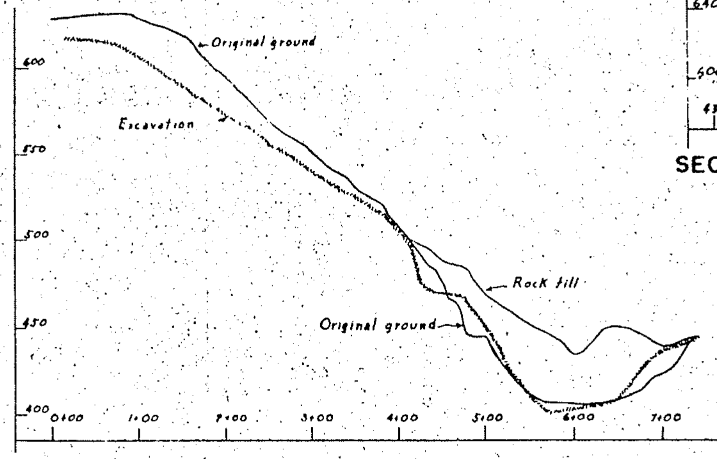
DESIGN "B"



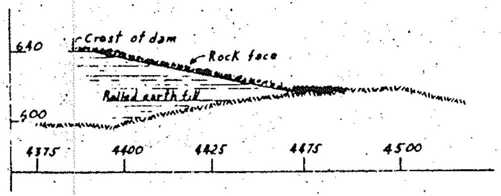
DESIGN "A"

cutoff collar at Stations 7+50 8+90





EXCAVATION FOR 3:1 SLOPE
SECTION C-C SHEET NO. 1 & 2
1" = 100'



SECTION ALONG AXIS AT NORTH END
1" = 25'

[illegible] of the [illegible] to safety
W. A. Brown 10-6-59

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

LEROY ANDERSON DAM

DATUM USC&GS
SCALE AS SHOWN
MARCH 1951

DETAILS OF DAM
AND OUTLET WORKS
AS CONSTRUCTED
SHEET 4 OF 5

S.W. HUNT
CHIEF ENGINEER
SAN JOSE CALIF

DR	CK
TR	AP

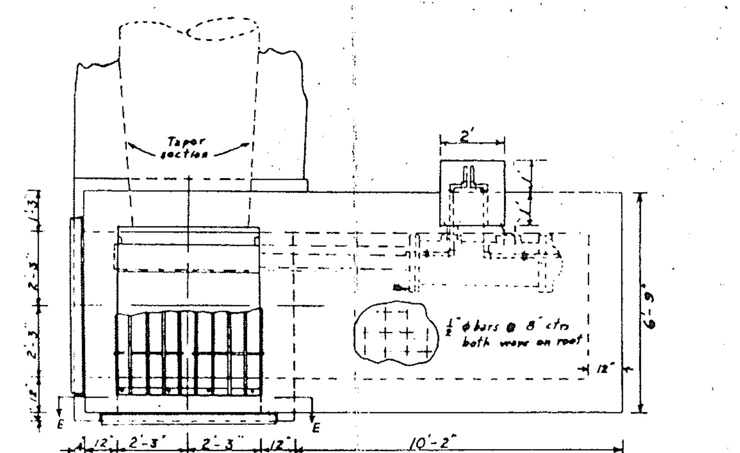
FILE NUMBER
P4 F3

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

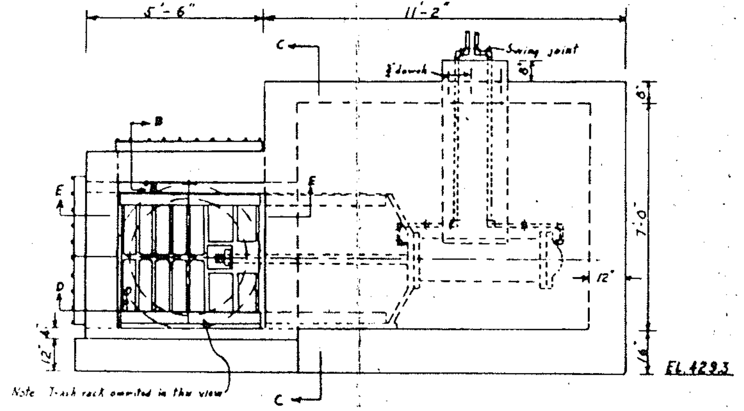
APPLICATION NO. 72-9
APPROVED AS TO SAFETY

10-9-59
DATE

DIRECTOR



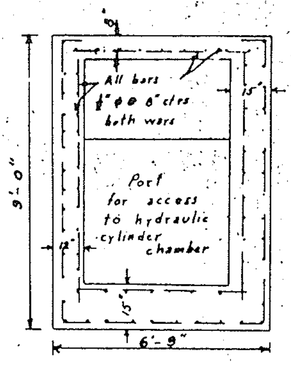
PLAN VIEW



FRONT ELEVATION

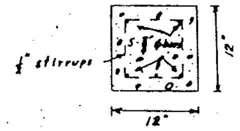
INLET DETAILS

3/8" = 1'


All bars 1/2" φ @ 6" ctrs both ways
Port for access to hydraulic cylinder chamber
9'-0"
15"
12"
6'-9"

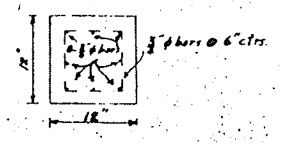
SECTION C-C

3/8" = 1'



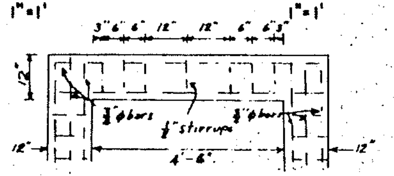
SECTION B-B

1" = 1'



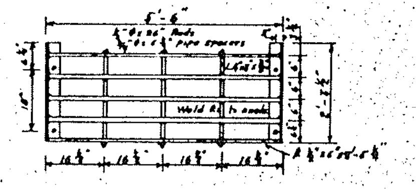
SECTION D-D

1" = 1'



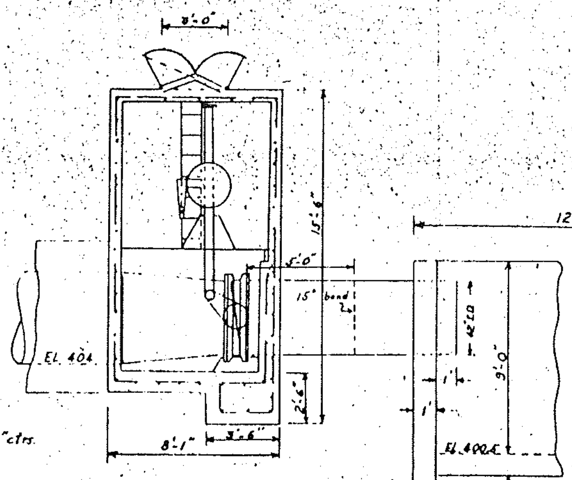
SECTION E-E

1/2" = 1'

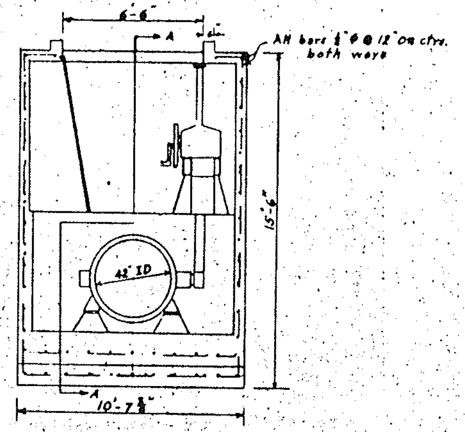


TRASH RACK

1/2" = 1'

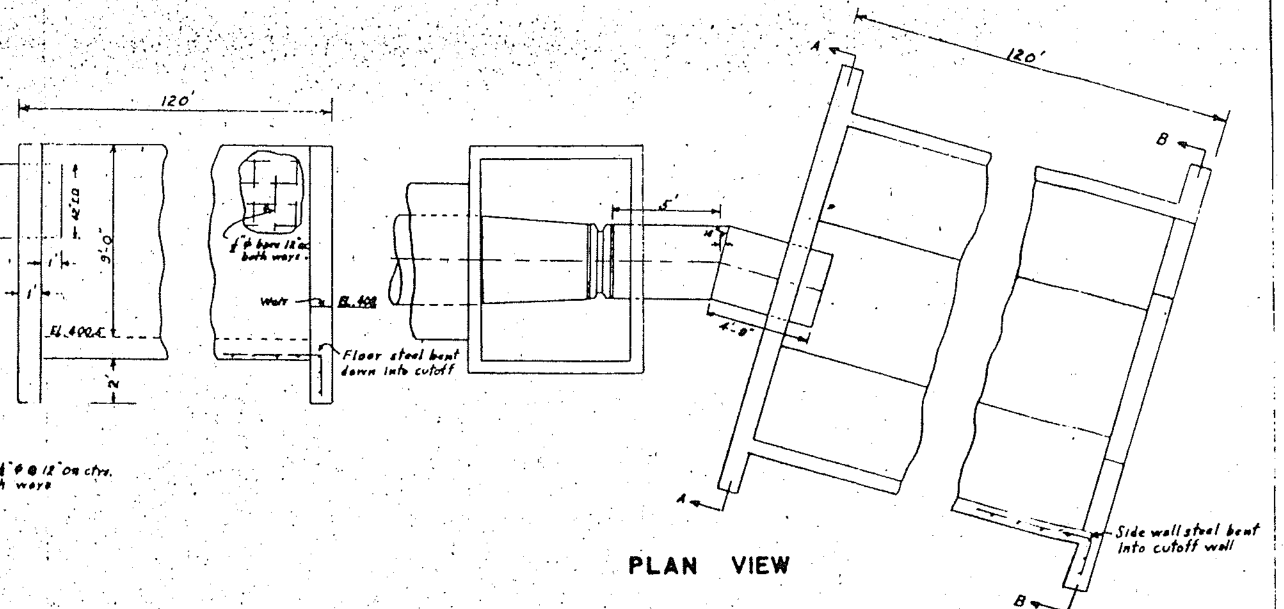


SECTION A-A

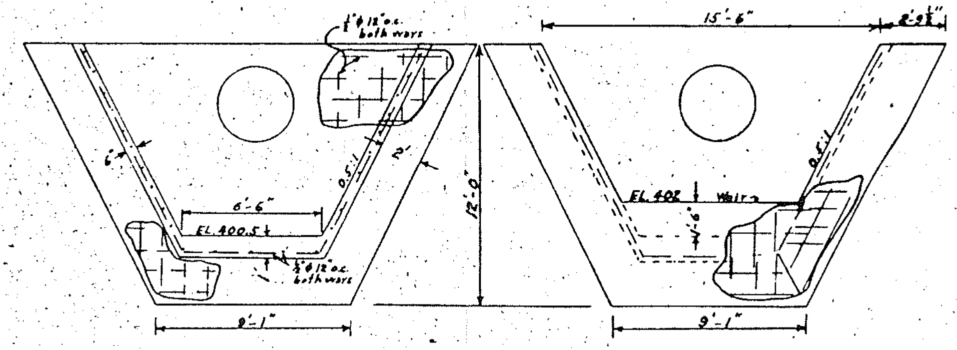


FRONT

BUTTERFLY VALVE


120'
120'
12'-0
9'-0
EL. 400.5
EL. 402
Weir
Floor steel bent down into cutoff
5'
4'-0"
A
A
B
B
Side wall steel bent into cutoff wall

PLAN VIEW

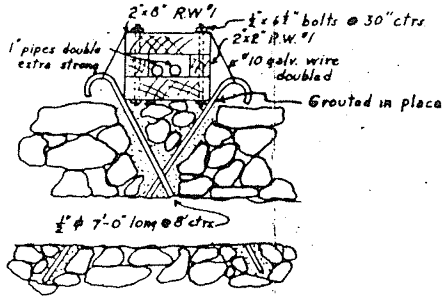


SECTION A-A

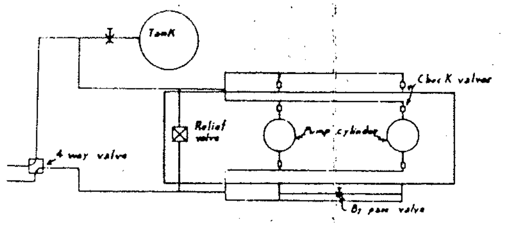
SECTION B-B

OUTLET DETAILS

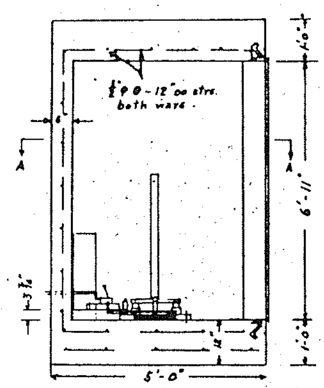
1/4" = 1'


2"x8" RW #1
1/2"x6 1/2" bolts @ 30" ctrs
2x2" R.W. #1
1" pipes double extra strong
#10 galv. wire doubled
Grouted in place
1/2" φ 7'-0" long @ 8" ctrs.

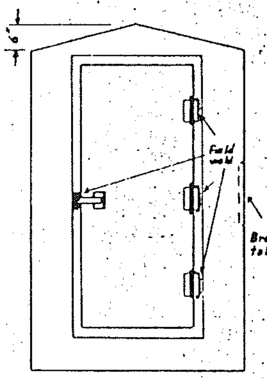
PROTECTION FOR PIPE
NO SCALE



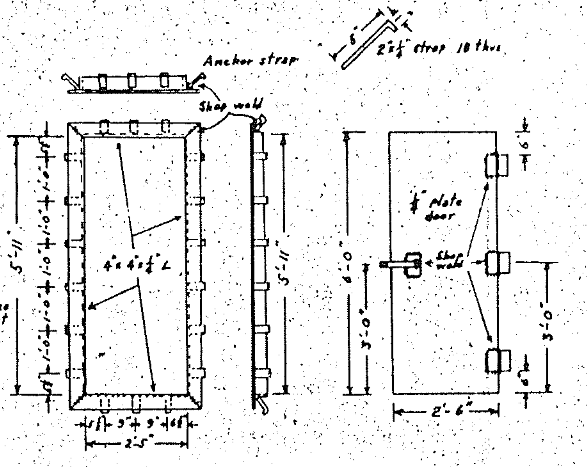
PIPING DIAGRAM



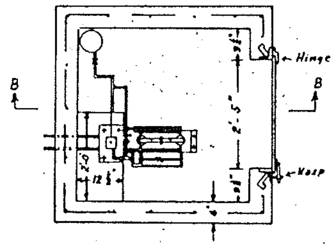
SECTION B-B



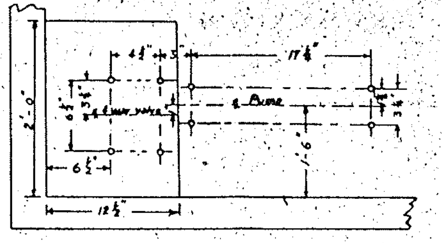
FRONT



DOOR AND FRAME DETAIL



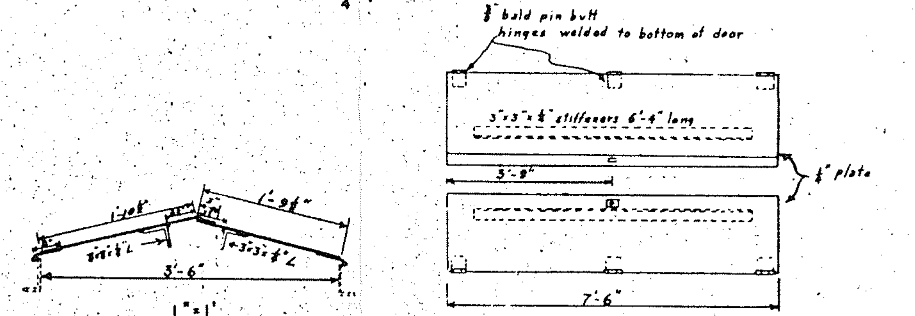
SECTION A-A



ANCHOR BOLT LAYOUT PLAN VIEW

HYDRAULIC LINE & LOCKER DETAILS

1/2" = 1'


3/8" bold pin butt hinges welded to bottom of door
3"x3"x1/4" stiffeners 6'-4" long
1/4" plate
3'-9"
7'-6"
1'-10"
1'-9 3/4"
3'-6"

1" = 1'

1/2" = 1'

DOOR DETAILS FOR OUTLET VALVE VAULT

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

LEROY ANDERSON DAM

DATUM USCGS
SCALE AS SHOWN
MARCH 1951

DR/J8 CK
TR/J8 AP

INLET AND OUTLET
STRUCTURES
AS CONSTRUCTED
SHEET 3 OF 5

G.W. HUNT
CHIEF ENGINEER
SAN JOSE CALIF

FILE NUMBER
P 4 F 3

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Recommended for the approval of the Director
W. A. Brown 10-6-59
Principal Engineer

APPLICATION NO. 72-9
APPROVED AS TO SAFETY

10-9-59
DATE

DIRECTOR

APPENDIX B

Emergency Evacuation Plan

DAM FAILURE EVACUATION PLAN

FACILITY NO. 3

LEROY ANDERSON RESERVOIR

Annex Approved
By:

Name ________ Title Police Chief Date 1-30-78

Name William S. [illegible] Title Chief of Police Date 1-30-78

Name James M. Geary Title Sheriff Date 2/1/78

DAM EVACUATION PLAN
FACILITY NO. 3
LEROY ANDERSON RESERVOIR

FACT SHEET

ACRE FEET: 91,300

DAM HEIGHT: 235'

OWNER: Santa Clara Valley Water District

PHONE: Watch Commander
299-2501
359-8121 (24 Hrs.)
Radio Frequency 12
151.145 MHz

AREA AFFECTED: Santa Clara County, Cities of San Jose, Morgan Hill, Gilroy and San Benito County

ESTIMATED NUMBER OF PEOPLE THREATENED: 123,000

NUMBER OF CONGREGATE CARE CENTERS REQUIRED:

RESPONSIBLE AGENCIES:

Warning and Assembly Element: Santa Clara County Sheriff's Department

Transportation and Routes Element: Santa Clara County Transportation Agency

Traffic Control Element: California Highway Patrol

Care of Evacuees Element: Santa Clara County Department of Social Services

Area Security Element: Santa Clara County Sheriff's Department

EVACUATION CONTROL CENTER: County Emergency Operations Center

COMMAND POSTS EVACUATION FORCE:

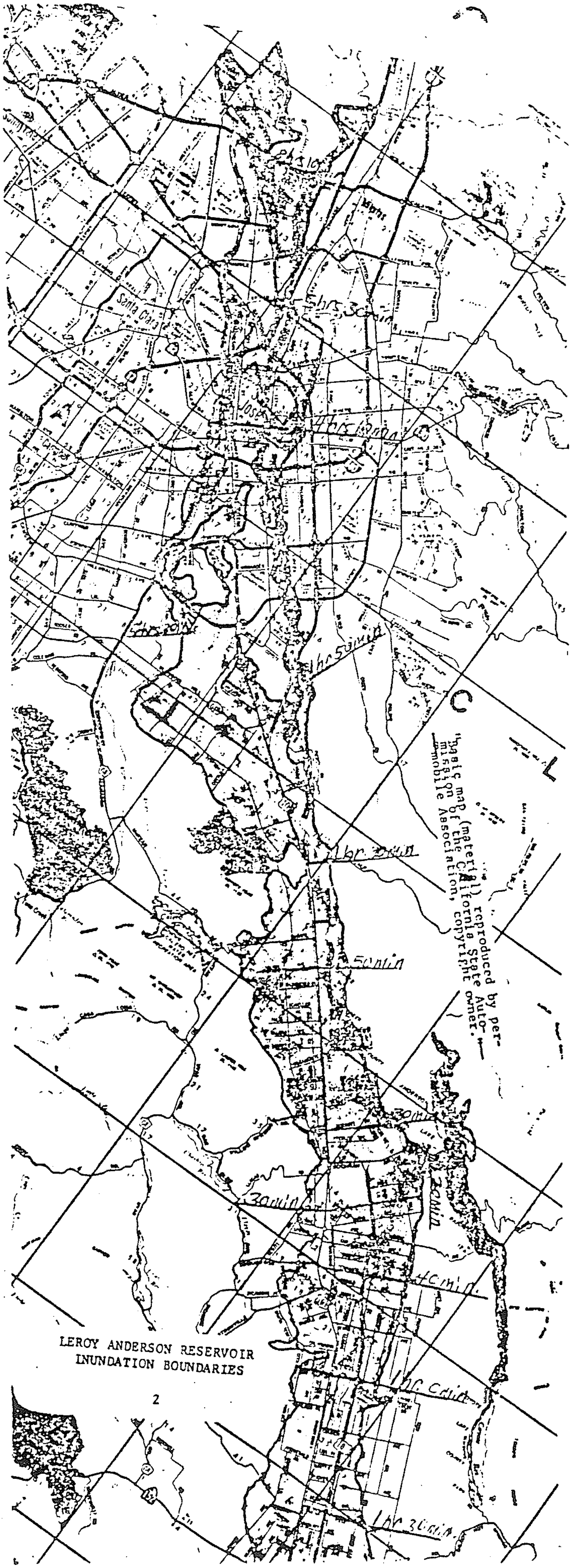
Sector A: Gavilan Community College
5055 Santa Teresa Blvd.
Gilroy (408) 847-1400

Sector B: Morgan Hill City Hall
17555 Peak Avenue
Morgan Hill (408) 779-3121

Sector C: To be determined by the City of San Jose

NUMBER OF KEY FACILITIES: 18

NUMBER OF UNIQUE INSTITUTIONS: 88



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LEROY ANDERSON RESERVOIR
INUNDATION BOUNDARIES

2

SECTOR A

Note: Sector A consists of all inundation areas south of Church Avenue to San Benito County Line. See Sector A Evacuation Map.

WARNING AND ASSEMBLY ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Santa Clara County Sheriff's Department

EVACUATION FORCE COMMANDER: Gilroy Chief of Police

EVACUATION FORCES: Gilroy Police Department, Gilroy Fire Department, Gilroy Rural Fire Department

ESTIMATED NUMBER OF PEOPLE THREATENED: 16,000

NUMBER OF WARNING AREAS: 4 See Sector A Evacuation Map

COMMAND POST: See Sector A Evacuation Map (Symbol CP)

Gavilan Community College
5055 Santa Teresa Blvd.
Gilroy (408) 847-1400

FLOOD WAVE ARRIVAL TIME (F.W.A.T.): Travel time of the flood wave from the reservoir to the end of the inundation area is 8 hours, 10 minutes north and 6 hours, 10 minutes south.

ASSEMBLY POINTS: 2 See Sector A Evacuation Map (Symbol ●)

1. Gavilan Community College (has County Communications receiver)
   5055 Santa Teresa Blvd.
   Gilroy (408) 847-1400

2. Elks Lodge
   2765 Hecker Pass Highway
   Gilroy (408) 842-9397

ROUTES: See Sector A Evacuation Map (Symbol →)

CONGREGATE CARE CENTERS ASSIGNED: 2 See Sector A Evacuation Map (Symbol Ⓧ)

1. Gavilan Community College
   5055 Santa Teresa Blvd.
   Gilroy (408) 847-1400

2. Elks Lodge
   2765 Hecker Pass Highway
   Gilroy (408) 842-9397

COMMUNICATIONS:

Primary: Gilroy Police, 155.085 MHz
South County Fire, 154.145 MHz

Secondary: Mutual Aid Law, 154.920 MHz
Mutual Aid Fire, 154.280 MHz

SECTOR A

WARNING AND ASSEMBLY ELEMENT
ANDERSON RESERVOIR
(Continued)

KEY FACILITIES: 5 See Sector A Evacuation Map (Symbol ▣)

1. Gilroy City Hall
   7390 Rosanna St., 842-3191

2. Gilroy Police Dept.
   7390 Rosanna St., 842-6456

3. Gilroy Fire Dept.
   7070 Chestnut St., 842-5656

4. Gilroy Rural Fire Dept.
   7331 Church St., 842-3137

5. Gilroy Fire Dept.
   55 5th St., 842-5005

UNIQUE INSTITUTIONS: 14 See Sector A Evacuation Map (Symbol ★)

**1.	Brownell School, 7800 Carmel St., Gilroy	842-3135
**2.	Eliott School, 470 Seventh St., Gilroy	842-5618
**3.	El Roble School, 930 Third St., Gilroy	842-8234
**4.	Glen View School, 600 Eighth St., Gilroy	842-8292
**5.	Las Animas School, 8450 Wren Ave., Gilroy	842-6414
**6.	Rucker School, 325 Santa Clara Ave., Gilroy	842-6471
**7.	San Ysidro School, 2220 Pacheco Pass, Gilroy	842-0292
**8.	Gilroy High School, 385 I.O.O.F. Ave., Gilroy	847-2424
**9.	Mt. Madonna High School, 7663 Church St., Gilroy	842-4313
10.	St. Mary's Catholic Church School, 7900 Church St., Gilroy	842-2827

** District Office has alert monitor receiver on County Communications Frequency 18,158.820MHz

Day Care Centers

11.	Heidi's Learning Center, 7299 Eigleberry, Gilroy	842-7455
12.	Madonna Village Day Care Center, 7931 Miller Ave., Gilroy	842-4689

Convalescent Homes and Hospitals

13.	Driftwood Convalescent Hospital, 8170 Murry Ave., Gilroy	842-9311
14.	Wheeler Hospital, 651 W. 6th St., Gilroy	842-5621

SECTOR A

TRANSPORTATION AND ROUTES ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Director of County Transportation Agency

TRANSPORTATION SOURCE: County Transit District, Gilroy Unified School District, Gavilan Joint Community College District

CONTACTS:

County Transit District

1st	William J. Blair	Bus:	265-2600	Home:	264-1958
2nd	Chuck Fagan	Bus:	265-2600	Home:	258-8952
3rd	William Wakaluk	Bus:	265-2600	Home:	241-0783

Gilroy Unified School District

1st	Robert Infelise, Dist. Supt.	Bus:	842-8285	Home:	847-7001
2nd	Vance Baldwin, Assoc. Supt.	Bus:	842-8285	Home:	842-6619
3rd	Jim Marlow	Bus:	842-8285	Home:	842-3667

Gavilan Joint Community College District

1st	Tom Alderson	Bus:	847-1400	Home:	683-2633
2nd	George McCarthy	Bus:	847-1400	Home:	225-3640
3rd	Chuck Geary	Bus:	847-1400	Home:	842-5309

ESTIMATED NUMBER OF PEOPLE THREATENED: 16,000

ESTIMATED NUMBER OF PEOPLE REQUIRING TRANSPORTATION: 4,800

TRANSPORTATION REQUIRED: 6 vans and 23 buses for a combined capacity of 1,176. Note: See Sector B Transportation Element for County Transit's contribution.

SECTOR A

TRAFFIC CONTROL ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Gilroy Police Department

SOURCE OF PERSONNEL: Gilroy Police Department, Sheriff's Department, California Highway Patrol

TRAFFIC CONTROL POINTS: 12 See Sector A Evacuation Map (Symbol $\overset{1}{\text{TCP}}$)

Note: Numbered in order of priority

Location:	Responsibility:
1. Intersection of Monterey St. and First St.	Gilroy Police Dept.
2. Intersection of Monterey St. and Sixth St.	Gilroy Police Dept.
3. Intersection of Monterey St. and Thomas Rd.	Gilroy Police Dept.
4. Intersection of Hecker Pass Hwy. and Santa Teresa Blvd.	Gilroy Police Dept.
5. Intersection of Miller Ave. and First St.	Gilroy Police Dept.
6. Intersection of Monterey St. and Eighth St.	Gilroy Police Dept.
7. Intersection of Miller Ave. and Sixth St.	Gilroy Police Dept.
8. Intersection of Miller Ave. and Santa Teresa Blvd.	Gilroy Police Dept.
9. Intersection of Thomas Rd. and Santa Teresa Blvd.	Gilroy Police Dept.
10. Intersection of Mesa Rd. and Santa Teresa Blvd.	Gilroy Police Dept.
11. Intersection of Mesa Rd. and Frontage Rd.	Gilroy Police Dept.
12. Intersection of Frontage Rd. and Castro Valley Rd.	Gilroy Police Dept.

BARRICADES: 5 See Sector A Evacuation Map (Symbol $\overset{1}{\#}$)

Location:	Responsibility:
1. Leavesley Rd. at New Ave.	Gilroy Public Works
2. Dunlap Ave. at Furlong Ave.	Gilroy Public Works
3. Pacheco Pass Rd. at Furlong Ave.	Gilroy Public Works
4. Morey Ave. at Mantelli Dr.	Gilroy Public Works
5. Castro Valley Rd. at Santa Teresa Blvd.	Gilroy Public Works

Note: California Highway Patrol, Hollister Area Headquarters, upon notification from Santa Clara County Sheriff's Department, will do the following:

*Establish a traffic control point at California Highway 129 and U.S. 101 junction rerouting traffic from northbound U.S. 101 to California 129 to Watsonville.

*Establish a traffic control point at California Highway 156 and U.S. 101 junction rerouting San Joaquin Valley traffic onto California Highway 156 through Hollister to California Highway 152.

*California Highway Patrol, Los Banos Area Headquarters, would be notified by California Highway Patrol, Hollister Area Headquarters, to reroute traffic from San Joaquin Valley travelling toward Santa Clara Valley via California Highway 152 to Interstate Route 5.

*California Highway Patrol, Santa Cruz, would be notified by California Highway Patrol, Hollister Area Headquarters, to block California Highway 152 at Carlton Road (Santa Cruz County) thereby preventing 152 easterly traffic from Watsonville from entering Santa Clara County (inundated area).

SECTOR A

TRAFFIC CONTROL ELEMENT
ANDERSON RESERVOIR
(Continued)

BARRICADES: See Sector A Evacuation Map (Symbol #) (Continued)

- *California Highway Patrol, Hollister Area Headquarters, will block California Highway 25 (Bolsa Road) at Shore Road to prevent traffic from entering inundated area via 25.
- *California Highway Patrol, Hollister Area Headquarters, will also barricade California Highway 152 at west of 156 (Don Pacheco Y).
- *Any additional aid required by California Highway Patrol will be obtained through their (C.H.P.'s) contacting Cal Trans.

ROUTES: See Sector A Evacuation Map (Symbol ⟶)

SECTOR A

CARE OF EVACUEES ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Gilroy Parks and Recreation Department

ESTIMATED NUMBER OF PEOPLE THREATENED: 16,000

ESTIMATED NUMBER OF PEOPLE REQUIRING CONGREGATE CARE CENTERS: 4,800

CONGREGATE CARE CENTERS ASSIGNED: See Sector A Evacuation Map (Symbol ⓧ)

1. Name : Gavilan Community College — Phone: 847-1400
   Address : 5055 Santa Teresa Blvd., Gilroy
   Capacity: 3,000
   Contacts:

1st	Dr. R. Melone	Home: 779-7915
2nd	Dr. Donald Spellman	Home: 779-4320
3rd	William Reimel	Home: 842-6356
4th	Al Pierce, Custodian	Home: 842-3379

2. Name : Elks Lodge — Phone: 842-9397
   Address : 2765 Hecker Pass Hwy., Gilroy
   Capacity: 194
   Contacts:

1st	Norman Goodrich, Manager	Home: 842-3570
2nd	Robert Mozzone, Chairman of the Board of Trustees	Home: 842-4665
3rd	Leo Goforth, Exalted Ruler	Home: 842-2624

Note: Additional Congregate Care Facilities will be provided by San Jose Congregate Care Centers as needed. Transportation routing to San Jose facilities will be via Route 152 to County Road G-8. (See Supplemental Evacuation Map).

COMMUNICATIONS:

Primary: Telephone

Secondary: Hand held two-way receiver 45.380 MHz

CONGREGATE CARE CENTER STAFFING: Assigned school personnel, County Social Services, Red Cross, Gilroy Parks and Recreation Department

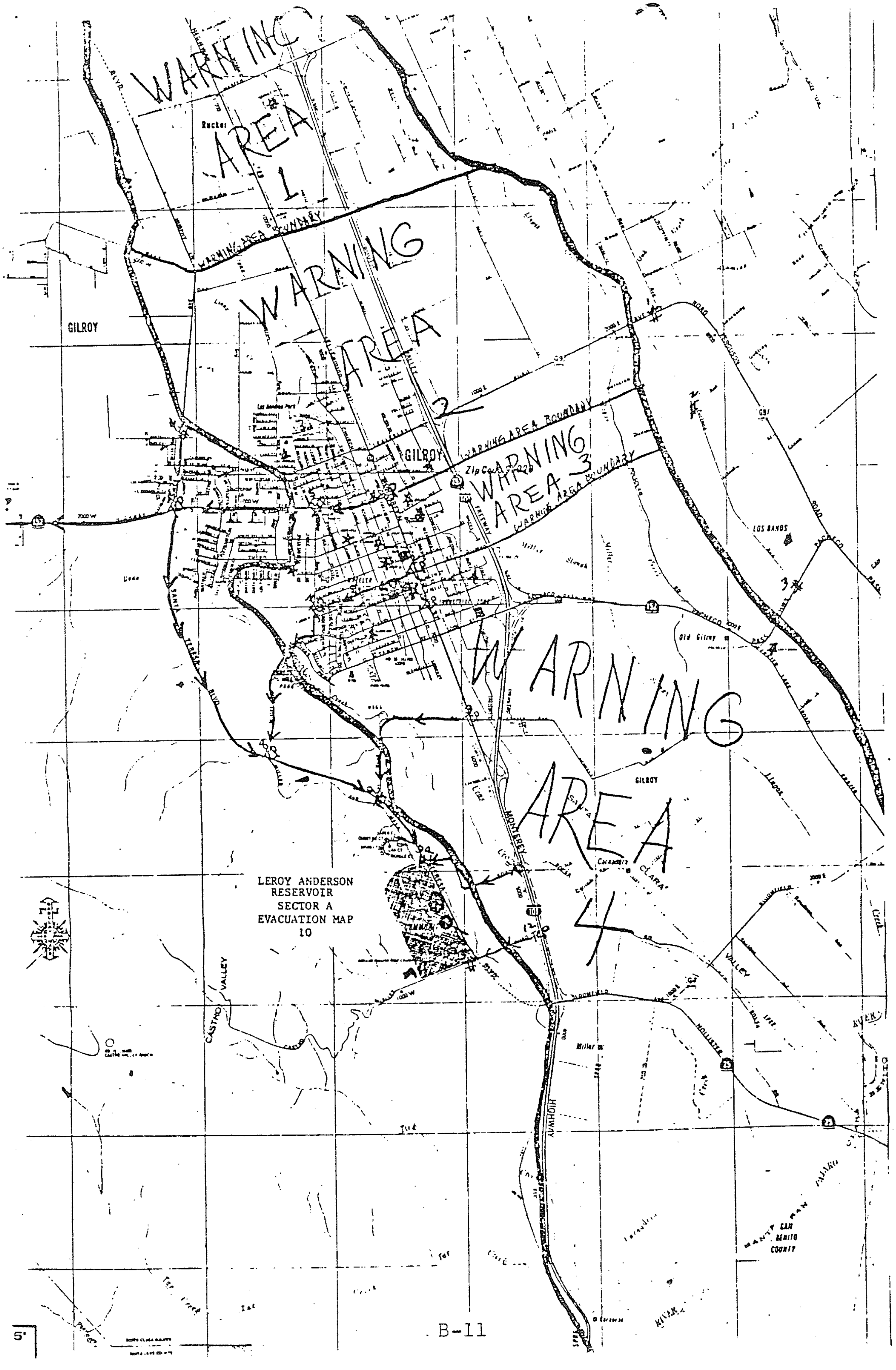
SECTOR A

AREA SECURITY ELEMENT
ANDERSON RESERVOIR

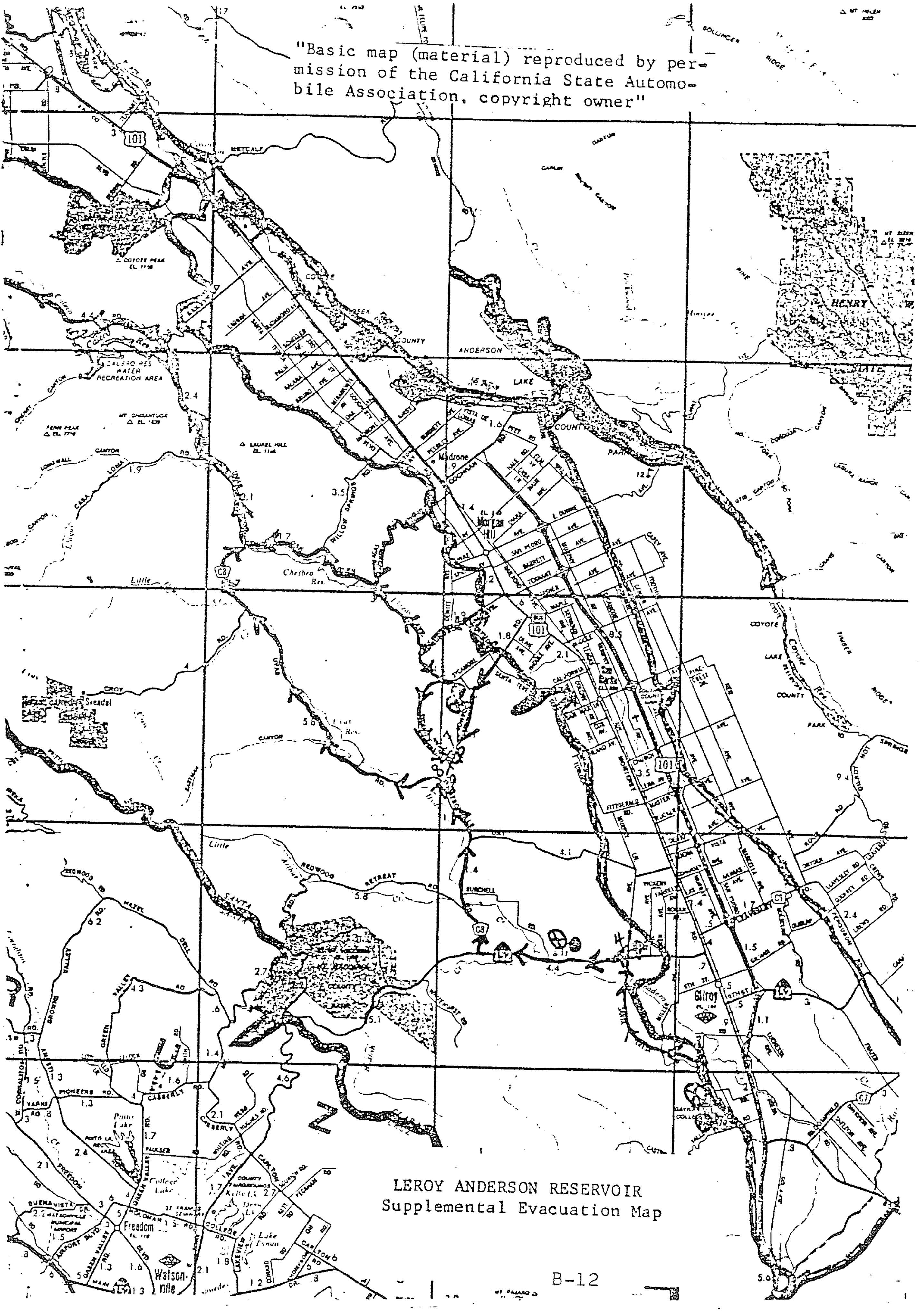
RESPONSIBLE AGENCY: Gilroy Police Department

SOURCE OF PERSONNEL: Gilroy Police Department, Sheriff's Department

PATROL ROUTES: Patrol schedule and frequency will be determined by Law Enforcement Officer in charge based on existing conditions and availability of personnel.



LEROY ANDERSON
RESERVOIR
SECTOR A
EVACUATION MAP
10



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LEROY ANDERSON RESERVOIR
Supplemental Evacuation Map

SECTOR B

Note: Sector B consists of the inundated area south of Burnett Avenue (including Burnett School) and north of Church Avenue. See Sector B Evacuation Map.

WARNING AND ASSEMBLY ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Santa Clara County Sheriff's Department

EVACUATION FORCE COMMANDER: Morgan Hill Chief of Public Safety

EVACUATION FORCES: Santa Clara County Sheriff's Department, Morgan Hill Police Department, Morgan Hill Rural Fire Department, Morgan Hill Fire Department

ESTIMATED NUMBER OF PEOPLE THREATENED: 9,000

NUMBER OF WARNING AREAS: 2 See Sector B Evacuation Map

COMMAND POST: See Sector B Evacuation Map (Symbol CP)

Morgan Hill City Hall
17555 Peak Avenue, Morgan Hill
(408) 779-3121

FLOOD WAVE ARRIVAL TIME (F.W.A.T.): Travel time of the flood wave from the reservoir to the end of the inundation area is 8 hours, 10 minutes north and 6 hours, 10 minutes south.

ASSEMBLY POINTS: 2 See Sector B Evaucation Map (Symbol ●)

1. Machado School
   15130 Sycamore Avenue, Morgan Hill
   (408) 779-3279

2. Hacienda School
   19950 McKean Road, San Jose
   (408) 998-6229

ROUTES: See Sector B Evacuation Map (Symbol ⟶)
(Also see Supplemental Evacuation Map)

CONGREGATE CARE CENTERS ASSIGNED: 2 See Sector B Evacuation Map (Symbol ⓧ)

1. Machado School (capacity 50 persons)
   151 Sycamore Avenue, Morgan Hill
   (408) 779-3279

2. Morgan Hill Public Library (capacity 750 persons)
   17555 Peak Avenue, Morgan Hill
   (408) 779-3196

Note: The remaining people requiring Congregate Care Centers will be transported to San Jose and placed in Congregate Care Centers in San Jose.

SECTOR B

WARNING AND ASSEMBLY ELEMENT
ANDERSON RESERVOIR
(Continued)

COMMUNICATIONS:

Primary: Police Department, 155.115 MHz
South County Fire, 154.145 MHz

Secondary: Mutual Aid Law, 154.920 MHz
Mutual Aid Fire, 154.280 MHz

KEY FACILITIES: 5 See Sector B Evacuation Map (Symbol ▣)

1. Morgan Hill Fire Dept., 18300 Old Monterey Rd., Morgan Hill, 779-7231 or 779-4111.
2. Morgan Hill Rural Fire Dept., 15670 Monterey Rd., Morgan Hill, 779-4111 or 779-2121.
3. South County Offices, 80 Highland Ave., San Martin, 683-4121.
4. South County Coach Terminal, 540 Diessner Ave., San Martin, 683-4626.
5. Fire Station on Colony Ave., San Martin, 683-2050.

UNIQUE INSTITUTIONS: 15 See Sector B Evacuation Map (Symbol ☆)

1. Britton School, 80 W. Central Ave., Morgan Hill, 779-5201
2. Burnett School, 85 Tilton Ave., Morgan Hill, 779-5241
3. Central High School, 17450 Monterey, Morgan Hill, 779-5244
4. Gwinn School, 95 North St., San Martin, 779-5219
5. Live Oak High School, 1505 E. Main Ave., Morgan Hill, 779-5210
6. Morgan Hill School, 17020 Monterey, 779-5246
7. Nordstrom School, 1425 E. Dunne Ave., Morgan Hill, 779-5278
8. San Martin School, 100 North St., San Martin, 779-5220
*9. Walsh School, 353 W. Main Ave., Morgan Hill, 779-5211
10. St. Catherine's School, 17500 Peak Ave., Morgan Hill, 779-9950
11. William F. James Boys' Ranch, 19050 Malguerra, Morgan Hill, 779-2111
12. Harold Holden Ranch for Boys, 19050 Malguerra, Morgan Hill, 779-2111

*Has alert monitor on County Communications Frequency 18, 158.820 MHz

Day Care Centers and Nursery Schools

13. Morgan Hill Patent-Child Nursery School, 16870 Murphy Ave., Morgan Hill, 779-4515
14. South Valley Christian School, 145 Wright Ave., Morgan Hill, 779-8850

Convalescent Homes and Hospitals

15. Elder Care Convalescent Hospital, 16095 Church St., Morgan Hill, 779-7346

SECTOR B

TRANSPORTATION AND ROUTES ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Director County Transportation Agency

TRANSPORTATION SOURCE: County Transit District
Morgan Hill Unified School District

CONTACTS:

County Transit District

1st	William J. Blair	Bus:	265-2600	Home:	254-1958
2nd	Chuck Fagan	Bus:	265-2600	Home:	258-8952
3rd	William Wakaluk	Bus:	265-2600	Home:	241-0783

Morgan Hill Unified School District

1st	Bill Speegle	Bus:	779-5272	Home:	779-9480
2nd	Ron Jones	Bus:	779-5272	Home:	779-2705
3rd	Dale Landes	Bus:	779-5272	Home:	939-1320 (415)

ESTIMATED NUMBER OF PEOPLE THREATENED: 9,000

ESTIMATED NUMBER OF PEOPLE REQUIRING TRANSPORTATION: 2,700

TRANSPORTATION REQUIRED: 38 buses and 11 vans, with a combined total capacity of 2,939.

SECTOR B

TRAFFIC CONTROL ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Morgan Hill Police Department

SOURCE OF PERSONNEL: Morgan Hill Police Department, Santa Clara County Sheriff's Department, California Highway Patrol

TRAFFIC CONTROL POINTS: 10 See Sector B Evacuation Map (Symbol TCP)
(Also see Supplemental Evacuation Map)

Note: Numbered in order of priority

Location:	Responsibility:
1. Intersection of Cochran Rd. and Hwy. 101	Morgan Hill Police
2. Intersection of Monterey St. and Main Ave.	Morgan Hill Police
3. Intersection of Monterey St. and Dunne Ave.	Morgan Hill Police
4. Intersection of Monterey Highway and Watsonville Rd.	Morgan Hill Police
5. Intersection of Monterey St. and Wright Ave.	Morgan Hill Police
6. Intersection of Sunnyside Ave. and Watsonville Rd.	Morgan Hill Police
7. Intersection of County Road G-8 (Watsonville Rd.) and Sycamore Ave.	Morgan Hill Police
8. Intersection of County Road G-8 (Watsonville Rd.) and Uvas Rd.	Morgan Hill Police
9. Intersection of Dewitt Ave. and Dunne Ave.	Morgan Hill Police
10. Highway 101 at San Martin Ave.	Sheriff's Department

Note: for California Highway Patrol aid, see note at the end of Sector A, Leroy Anderson Dam Evacuation Plan, Traffic Control Element.

BARRICADES: See Sector B Evacuation Map (Symbol #)

Location:	Supplier:
1. Willow Springs Rd. at the fork in the road	Morgan Hill Public Works
2. Barnard Rd. at Coyote Rd.	Morgan Hill Public Works
3. Dunne Ave. at Hill Rd.	Morgan Hill Public Works
4. Fountain Oaks D. at Ponderosa Ct.	Morgan Hill Public Works
5. Tennant Ave. (midway) between Hill Rd. and Foothill Ave.	Morgan Hill Public Works
6. Maple Ave. at Center Ave.	Morgan Hill Public Works
7. Middle Ave. and Center Ave.	Morgan Hill Public Works
8. San Martin at Colombet Ave.	Morgan Hill Public Works
9. Colombet Ave. at Sherry Lane	Morgan Hill Public Works
10. Church Ave. at Colombet Ave.	Morgan Hill Public Works
11. Highland Ave. at Coolidge Ave.	Morgan Hill Public Works
12. Tilton at Highway 101 (Monterey Highway)	Morgan Hill Public Works
13. Monterey Highway at Edmundson	Morgan Hill Public Works

EVACUATION FORCE COMMANDER: Morgan Hill Public Safety Director

EVACUATION FORCE COMMAND POST: See Sector B Evacuation Map (Symbol CP)

Morgan Hill City Hall
17555 Peak Avenue
Morgan Hill (408) 779-3121

SECTOR B

TRAFFIC CONTROL ELEMENT
ANDERSON RESERVOIR
(Continued)

ASSEMBLY POINTS: See Sector B Evacuation Map (Symbol ●)

Machado School
15130 Sycamore Avenue
Morgan Hill (408) 779-3279

Morgan Hill City Library
17555 Peak Avenue
Morgan Hill (408) 779-3196

ROUTES: See Sector B Evacuation Map (Symbol ⟹)
(Also see Supplemental Evacuation Map)

SECTOR B

CARE OF EVACUEES ELEMENT
ANDERSON RESERVOIR

RESPONDIBLE AGENCY: Morgan Hill Parks and Recreation Department

ESTIMATED NUMBER OF PEOPLE THREATENED: 9,000

ESTIMATED NUMBER OF PEOPLE REQUIRING CONGREGATE CARE CENTERS: 2,700

CONGREGATE CARE CENTERS ASSIGNED: See Sector B Evacuation Map (Symbol ⓧ)

1. Name : Machado School Phone: 779-3279
   Address : 15130 Sycamore Ave., Morgan Hill
   Capacity: 50
   Contacts:

   1st Paul Gothard Home: 779-3901
   2nd Ellen Fieldgrove Home: 779-2314
   3rd Ronnie Jones Home: 779-2705

2. Name : Morgan Hill City Library Phone: 779-3196
   Address : 17555 Peak Ave., Morgan Hill
   Capacity: 370
   Contacts:

   1st Tom Upchurch Home: 225-9413
   2nd Troy Mitchell Home: 779-2663
   3rd Jean Anders Home: 779-2515

Note: (See Supplemental Evacuation Map). Additional Congregate Care Centers will be supplied by San Jose Sector. Overflow from Machado School and Morgan Hill Library will be routed north via Oak Glen Avenue and Willow Springs Road to County Road G-8, Uvas Road, McKeen Road where they will assemble at Hacienda School for further direction to available Congregate Care Centers in San Jose.

COMMUNICATIONS:

Primary: Hand-held Police Frequency 155.155MHz

Secondary: Hand-held CB, Channel 9

CONGREGATE CARE CENTER STAFFING: Assigned school personnel, Morgan Hill Parks and Recreation Department, American Red Cross

SECTOR B

AREA SECURITY ELEMENT
ANDERSON RESERVOIR

RESPONSIBLE AGENCY: Santa Clara County Sheriff's Department

SOURCE OF PERSONNEL: Sheriff's Department, Morgan Hill Police Department

BARRICADES (Unmanned): See Sector B Evacuation Map (Symbol #)

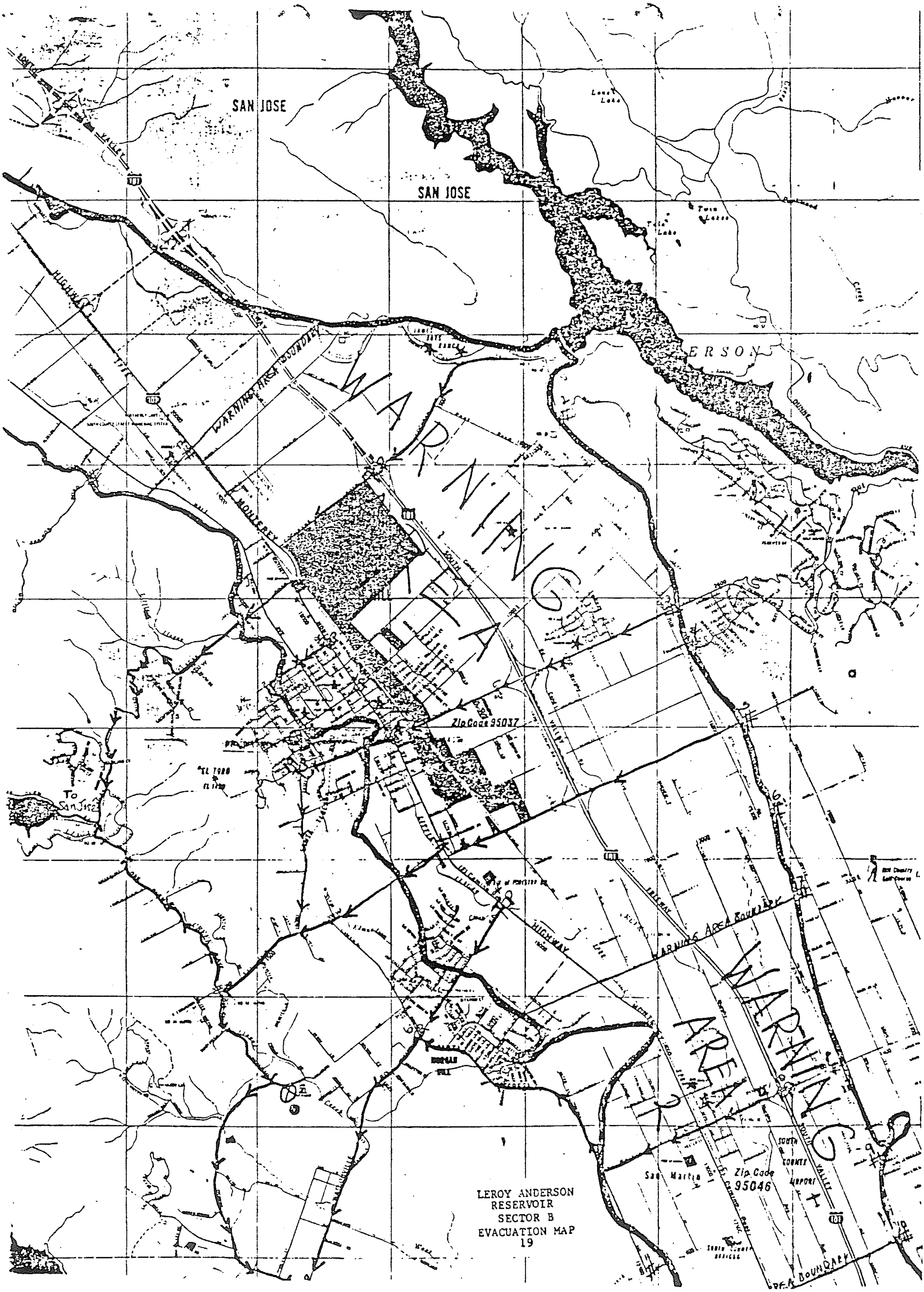
PATROL ROUTES: Patrol schedule and frequency will be determined by Law Enforcement Officer in charge based on existing conditions and availability of personnel.

COMMUNICATIONS:

Primary: Police, 155.115 MHz
South County Fire, 154.145 MHz

Secondary: Mutual Aid Law, 154.920 MHz
Mutual Aid Fire, 154.280 MHz

EVACUATION FORCE COMMANDER: Morgan Hill Public Safety Director



LEROY ANDERSON
RESERVOIR
SECTOR B
EVACUATION MAP
19

SECTOR C

SAN JOSE

To be completed by the City of San Jose

APPENDIX C

Probable Maximum Flood Study

Page	Item
C-1 through C-6	Probable Maximum Flood
C-7 through C-15	80 Percent Probable Maximum Flood

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                        DWR - - DIVISION OF SAFETY OF DAMS
                   PROGRAM HEC-1M - MODULE CREATED AND TESTED 8/79

                              SEPTEMBER 17, 1980

                     LEROY ANDERSON DAM 72-9
                     HYDROGRAPH ANALYSIS
                     PMP STORM
                                  JOB SPECIFICATION
         NQ      NHR      NMIN      IDAY      IHR      IMIN     METRC      IPLT      IPRT    NSTAN
         72        1         0         0        0         0         0         0         0        0
                                   JOPER      NWT     LROPT     TRACE
                                       3        0         0         0

  **********          **********          **********          **********          **********

                            SUB-AREA RUNOFF COMPUTATION

                   FLOOD HYDROGRAPH (COYOTE RES)
                     ISTAQ     ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                         1         0        0        0        0        0        1        0        0
                                        HYDROGRAPH DATA
         IHYDG    IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
             1       0   119.80      0.0   119.80      0.0      0.0        0        0        0
                                           PRECIP DATA
               *TA       *RA      *TB      *RB     *TCC     *DUR        *N      *TF       *C1
             60.00      2.40  1440.00    15.30    60.00    60.00        72  1440.00     0.41
                                            LOSS DATA
      LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTICK    STRTL    CNSTL    ALSMX    RTIMP
          0     0.15      0.0     3.50     0.40      0.0     1.00      0.0      0.0      0.0      0.0
                                      UNIT HYDROGRAPH DATA
                               TC= 10.58    R= 10.71    NTA=   0
                                         RECESSION DATA
                        STRTQ=     0.0      QRCSN=     0.0      RTIOR= 1.00
                         ACCUMULATED PRECIPITATION (INTERVAL = 60.00MIN)
           0.0       2.40      3.59      4.55      5.33      6.13      6.82      7.46      8.06      8.64
           9.18      9.71     10.21     10.70     11.18     11.63     12.03     12.51     12.94     13.35
          13.76     14.15     14.54     14.93     15.30     15.56     15.81     16.06     16.30     16.53
          16.77     16.99     17.22     17.43     17.65     17.86     18.07     18.27     18.47     18.67
          18.86     19.06     19.25     19.43     19.62     19.80     19.98     20.15     20.33     20.50
          20.67     20.84     21.01     21.17     21.33     21.50     21.66     21.81     21.97     22.12
          22.28     22.43     22.53     22.73     22.87     23.02     23.16     23.31     23.45     23.59
          23.73     23.87     24.01
       UNIT HYDROGRAPH 63 END-OF-PERIOD ORDINATES, LAG=   9.65 HOURS, CP= 0.57   VOL= 1.00
           142.       530.      1077.      1713.      2408.      3118.      3744.      4211.      4513.      4635.
          4503.      4164.      3792.      3454.      3146.      2855.      2610.      2377.      2155.      1972.
          1796.      1635.      1490.      1357.      1236.      1126.      1025.       934.       850.       775.
           705.       643.       585.       533.       485.       442.       403.       367.       334.       304.
           277.       252.       230.       209.       191.       174.       158.       144.       131.       120.
           109.        99.        90.        82.        75.        68.        62.        57.        52.        47.
            43.        39.        35.

         0                                       END-OF-PERIOD FLOW
    MO.DA   HR.MN  PERIOD    RAIN    EXCS    LOSS    COMP Q      MO.DA   HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q

     1.01    1.00       1    0.14    0.07    0.07       10.       1.02   13.00      37    2.40    2.25    0.15     20148.
     1.01    2.00       2    0.14    0.07    0.07       47.       1.02   14.00      38    0.95    0.86    0.10     22840.
     1.01    3.00       3    0.14    0.07    0.07      123.       1.02   15.00      39    0.75    0.66    0.09     25239.
     1.01    4.00       4    0.14    0.08    0.07      247.       1.02   16.00      40    0.64    0.56    0.09     29344.
     1.01    5.00       5    0.15    0.08    0.07      423.       1.02   17.00      41    0.57    0.49    0.08     32401.
     1.01    6.00       6    0.15    0.08    0.07      654.       1.02   18.00      42    0.52    0.45    0.08     35159.
     1.01    7.00       7    0.15    0.09    0.07      938.       1.02   19.00      43    0.49    0.41    0.07     38371.
     1.01    8.00       8    0.16    0.09    0.07     1263.       1.02   20.00      44    0.46    0.39    0.07     41397.
     1.01    9.00       9    0.16    0.09    0.07     1622.       1.02   21.00      45    0.43    0.36    0.07     43026.
     1.01   10.00      10    0.16    0.10    0.07     2002.       1.02   22.00      46    0.41    0.35    0.07     43905.
     1.01   11.00      11    0.17    0.10    0.07     2385.       1.02   23.00      47    0.40    0.33    0.07     43250.
     1.01   12.00      12    0.17    0.10    0.07     2761.       1.03    0.0       48    0.38    0.32    0.06     42660.
     1.01   13.00      13    0.17    0.11    0.07     3124.       1.03    1.00      49    0.26    0.20    0.05     41101.
     1.01   14.00      14    0.18    0.11    0.07     3478.       1.03    2.00      50    0.25    0.19    0.05     38519.
     1.01   15.00      15    0.18    0.12    0.07     3824.       1.03    3.00      51    0.24    0.18    0.05     36346.
     1.01   16.00      16    0.19    0.12    0.07     4165.       1.03    4.00      52    0.23    0.18    0.05     35492.
     1.01   17.00      17    0.19    0.13    0.07     4502.       1.03    5.00      53    0.22    0.17    0.05     [illegible]
     1.01   18.00      18    0.20    0.13    0.07     4837.       1.03    6.00      54    0.21    0.16    0.05     32389.
     1.01   19.00      19    0.21    0.14    0.07     5173.       1.03    7.00      55    0.20    0.16    0.05     [illegible]
     1.01   20.00      20    0.21    0.15    0.07     5511.       1.03    8.00      56    0.20    0.15    0.05     [illegible]
     1.01   21.00      21    0.22    0.15    0.07     5854.       1.03    9.00      57    0.19    0.15    0.05     [illegible]
     1.01   22.00      22    0.23    0.16    0.07     6204.       1.03   10.00      58    0.19    0.14    0.05     [illegible]
     1.01   23.00      23    0.24    0.17    0.07     6563.       1.03   11.00      59    0.18    0.14    0.04     [illegible]
     1.02    0.0       24    0.25    0.18    0.07     6935.       1.03   12.00      60    0.18    0.13    0.04     26171.
     1.02    1.00      25    0.37    0.29    0.08     7335.       1.03   13.00      61    0.17    0.13    0.04     25170.
     1.02    2.00      26    0.39    0.31    0.08     7793.       1.03   14.00      62    0.17    0.13    0.04     [illegible]
     1.02    3.00      27    0.41    0.32    0.08     8329.       1.03   15.00      63    0.16    0.12    0.04     22003.
     1.02    4.00      28    0.42    0.34    0.08     8955.       1.03   16.00      64    0.16    0.12    0.04     21139.
     1.02    5.00      29    0.45    0.36    0.08     9657.       1.03   17.00      65    0.16    0.12    0.04     20171.
     1.02    6.00      30    0.47    0.39    0.09    10530.       1.03   18.00      66    0.15    0.11    0.04     [illegible]
     1.02    7.00      31    0.51    0.42    0.09    11485.       1.03   19.00      67    0.15    0.11    0.04     18254.
     1.02    8.00      32    0.55    0.46    0.09    12552.       1.03   20.00      68    0.15    0.11    0.04     17276.
     1.02    9.00      33    0.60    0.51    0.09    13727.       1.03   21.00      69    0.15    0.11    0.04     [illegible]
     1.02   10.00      34    0.69    0.59    0.10    15019.       1.03   22.00      70    0.14    0.10    0.04     16547.
     1.02   11.00      35    0.83    0.73    0.10    16442.       1.03   23.00      71    0.14    0.10    0.04     [illegible]
     1.02   12.00      36    1.19    1.08    0.12    18064.       1.04    0.0       72    0.14    0.10    0.04     15223.

                                                                          SUM   24.01   19.21    4.79   1255257.
                                                                              ( 610.)( 488.)( 122.)(35394.48)

                          PEAK     6-HOUR     24-HOUR     72-HOUR    TOTAL VOLUME
              CFS        43905.    42929.     35095.      17745.       1277533.
              CMS         1243.     1216.       994.        502.         36179.
           INCHES                    3.33      10.90       16.53         16.53
               MM                   84.67     276.87      419.97        419.97
            AC-FT                   21287.     69510.     105589.       105589.
      THOUS CU M                    26257.     85363.     130243.       130243.
```

O.K (23.87)

Too high.
There should be [illegible] starting flow and recession

Triangular distribution [illegible]

```
          **********          **********          **********          **********          **********
                                         HYDROGRAPH ROUTING
                       COYOTE RES FLOOD ROUTING
                         ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                             2        1        0        0        0        0        1        0        0
                                                ROUTING DATA
                 QLOSS   CLOSS      AVG     IRES    ISAME     IOPT     IPMP              LSTR
                   0.0     0.0     1.00        1        0        0        0                 0

                         NSTPS    NSTDL      LAG    AMSKK        X      TSK    STORA   ISPRAT
                             1        0        0      0.0      0.0      0.0      -1.       -1

  STORAGE        0.0     1800.00     3600.00     5400.00     7300.00     9200.00    11100.00    13000.00    1500
  OUTFLOW        0.0     1700.00     4900.00     9100.00    14000.00    19500.00    25700.00    32300.00    3950

                              0
                         MO.DA    HR.MN   PERIOD  EOP STOR    AVG IN   EOP OUT      STAGE  AVG PUMP

                          1.01     1.00        1       10.       10.       10.        0.0        0.
                          1.01     2.00        2       13.       47.       13.        0.0        0.
                          1.01     3.00        3       22.      123.       21.        0.0        0.
                          1.01     4.00        4       40.      247.       38.        0.0        0.
                          1.01     5.00        5       71.      423.       67.        0.0        0.
                          1.01     6.00        6      119.      654.      111.        0.0        0.
                          1.01     7.00        7      183.      938.      173.        0.0        0.
                          1.01     8.00        8      270.     1263.      255.        0.0        0.
                          1.01     9.00        9      379.     1622.      358.        0.0        0.
                          1.01    10.00       10      509.     2002.      481.        0.0        0.
                          1.01    11.00       11      661.     2386.      624.        0.0        0.
                          1.01    12.00       12      831.     2761.      785.        0.0        0.
                          1.01    13.00       13     1017.     3124.      961.        0.0        0.
                          1.01    14.00       14     1217.     3478.     1150.        0.0        0.
                          1.01    15.00       15     1430.     3824.     1351.        0.0        0.
                          1.01    16.00       16     1654.     4165.     1562.        0.0        0.
                          1.01    17.00       17     1885.     4502.     1851.        0.0        0.
                          1.01    18.00       18     2115.     4837.     2060.        0.0        0.
                          1.01    19.00       19     2339.     5173.     2558.        0.0        0.
                          1.01    20.00       20     2559.     5511.     3049.        0.0        0.
                          1.01    21.00       21     2775.     5854.     3433.        0.0        0.
                          1.01    22.00       22     2988.     6204.     3812.        0.0        0.
                          1.01    23.00       23     3200.     6563.     4169.        0.0        0.
                          1.02     0.0        24     3411.     6935.     4564.        0.0        0.
                          1.02     1.00       25     3624.     7355.     4956.        0.0        0.
                          1.02     2.00       26     3838.     7793.     5455.        0.0        0.
                          1.02     3.00       27     4055.     8329.     5961.        0.0        0.
                          1.02     4.00       28     4280.     8956.     6487.        0.0        0.
                          1.02     5.00       29     4521.     9687.     7050.        0.0        0.
                          1.02     6.00       30     4784.    10530.     7662.        0.0        0.
                          1.02     7.00       31     5072.    11486.     8335.        0.0        0.
                          1.02     8.00       32     5390.    12552.     9076.        0.0        0.
                          1.02     9.00       33     5737.    13727.     9970.        0.0        0.
                          1.02    10.00       34     6114.    15019.    10942.        0.0        0.
                          1.02    11.00       35     6525.    16442.    12002.        0.0        0.
                          1.02    12.00       36     6978.    18264.    13169.        0.0        0.
                          1.02    13.00       37     7497.    20148.    14570.        0.0        0.
                          1.02    14.00       38     8107.    22840.    16337.        0.0        0.
                          1.02    15.00       39     8818.    25969.    18395.        0.0        0.
                          1.02    16.00       40     9621.    29344.    20973.        0.0        0.
                          1.02    17.00       41    10489.    32801.    23703.        0.0        0.
                          1.02    18.00       42    11392.    36136.    26715.        0.0        0.
                          1.02    19.00       43    12285.    39071.    29917.        0.0        0.
                          1.02    20.00       44    13122.    41397.    32738.        0.0        0.
                          1.02    21.00       45    13852.    43026.    35402.        0.0        0.
                          1.02    22.00       46    14472.    43356.    37600.        0.0        0.
                          1.02    23.00       47    14926.    43705.    39233.        0.0        0.
                          1.03     0.0        48    15216.    43250.    40246.        0.0        0.
                          1.03     1.00       49    15361.    42260.    40749.        0.0        0.
                          1.03     2.00       50    15387.    41101.    40837.        0.0        0.
                          1.03     3.00       51    15313.    39519.    40583.        0.0        0.
                          1.03     4.00       52    15159.    38446.    40049.        0.0        0.
                          1.03     5.00       53    14939.    36998.    39279.        0.0        0.
                          1.03     6.00       54    14666.    35492.    38298.        0.0        0.
                          1.03     7.00       55    14353.    33948.    37171.        0.0        0.
                          1.03     8.00       56    14009.    32339.    35933.        0.0        0.
                          1.03     9.00       57    13643.    30839.    34613.        0.0        0.
                          1.03    10.00       58    13262.    29318.    33242.        0.0        0.
                          1.03    11.00       59    12873.    27854.    31860.        0.0        0.
                          1.03    12.00       60    12484.    26471.    30507.        0.0        0.
                          1.03    13.00       61    12098.    25170.    29167.        0.0        0.
                          1.03    14.00       62    11721.    23949.    27857.        0.0        0.
                          1.03    15.00       63    11356.    22803.    26588.        0.0        0.
                          1.03    16.00       64    11004.    21726.    25386.        0.0        0.
                          1.03    17.00       65    10664.    20717.    24276.        0.0        0.
                          1.03    18.00       66    10336.    19771.    23205.        0.0        0.
                          1.03    19.00       67    10021.    18884.    22178.        0.0        0.
                          1.03    20.00       68     9720.    18054.    21198.        0.0        0.
                          1.03    21.00       69     9435.    17276.    20266.        0.0        0.
                          1.03    22.00       70     9163.    16547.    19394.        0.0        0.
                          1.03    23.00       71     8903.    15863.    18540.        0.0        0.
                          1.04     0.0        72     8651.    15223.    17910.        0.0        0.

                                                             SUM    1189654.
                                                                (   33687.30)

                          PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                 CFS    40837.     40286.     34077.     16399.        1180694.
                 CMS     1156.      1141.       965.       464.          33434.
              INCHES                 3.13      10.58      15.28          15.28
                  MM                79.46     268.84     388.11         388.11
               AC-FT                19977.     67592.     97578.          97578.
          THOUS CU M                24641.     83373.    120361.         120361.

          **********          **********          **********          **********          **********
                                         HYDROGRAPH ROUTING
                       CHANNEL ROUTING
                         ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                             3        1        0        0        0        0        1        0        0
```

It assumes there is no starting flow and recession flows

This assumes the reservoir empty @ start of flood.

```
                                              ROUTING DATA
                QLOSS    CLOSS     AVG    IRES   ISAME     IOPT     IPMP              LSTR
                  0.0    0.0      0.0        0       0        0        0                 0

                         NSTPS   NSTDL     LAG   AMSKK        X      TSK    STORA   ISPRAT
                             1       0       0   2.060    0.200    0.0       -1.        0

                                          ROUTED FLOWS AT       3
     10.         10.         12.         17.         28.         47.         79.        126.        189.        272.
    374.        495.        635.        793.        966.       1152.       1353.       1549.       1920.       2276.
   2648.       3025.       3404.       3781.       4158.       4540.       4935.       5457.       5955.       6485.
   7055.       7675.       8357.       9140.      10014.      10978.      12045.      13230.      14773.      16543.
  18554.      21106.      23918.      26704.      29595.      32364.      34847.      36913.      38472.      39528.
  40123.      40314.      40162.      39716.      39017.      38116.      37055.      35874.      34604.      33284.
  31949.      30613.      29290.      27995.      26746.      25563.      24434.      23353.      22321.      21338.
  20410.      19564.

                              PEAK    6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
                     CFS    40314.    39764.     33874.     15843.       1140709.
                     CMS     1142.     1126.       959.       449.         32301.
                  INCHES                3.09      10.52      14.76          14.76
                      MM               78.43     267.23     374.97         374.97
                   AC-FT              19718.     67187.     94273.         94273.
              THOUS CU M              24322.     82875.    116285.        116285.


**********          **********          **********          **********          **********

                                     SUB-AREA RUNOFF COMPUTATION

                        FLOOD HYDROGRAPH (ANDERSON AREA 1)

                          ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                              4        0        0        0        0        0        1        0        0

                                        HYDROGRAPH DATA
              IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
                  1        0    45.30      0.0    45.30      0.0      0.0        0        0        0

                                         PRECIP DATA
                   *TA      *RA      *TB      *RB     *TCC     *DUR       *N      *TF      *C1
                 60.00     2.40  1440.00    15.30    60.00    60.00       72  1440.00     0.41

                                          LOSS DATA
           LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTICK    STRTL    CNSTL    ALSMX    RTIMP
               0     0.15      0.0     3.50     0.40      0.0     1.00      0.0      0.0      0.0      0.0

                                     UNIT HYDROGRAPH DATA
                             TC=  1.86      R=  5.73    NTA=  0

                                        RECESSION DATA
                         STRTQ=     0.0    QRCSN=     0.0    RTIOR= 1.00

                          ACCUMULATED PRECIPITATION (INTERVAL = 60.00MIN)
                0.0      2.40      3.59      4.55      5.38      6.13      6.82      7.46      8.06      8.64
                9.18     9.71     10.21     10.70     11.18     11.63     12.08     12.51     12.94     13.35
               13.76    14.15     14.54     14.93     15.30     15.56     15.81     16.06     16.30     16.53
               16.77    16.99     17.22     17.43     17.65     17.85     18.07     18.27     18.47     18.67
               18.86    19.06     19.25     19.43     19.62     19.80     19.98     20.15     20.33     20.50
               20.67    20.84     21.01     21.17     21.33     21.50     21.66     21.81     21.97     22.12
               22.28    22.43     22.59     22.73     22.87     23.02     23.16     23.31     23.45     23.59
               23.73    23.87     24.01

              UNIT HYDROGRAPH 32 END-OF-PERIOD ORDINATES, LAG=   2.24 HOURS, CP= 0.32   VOL= 1.00
         1302.        3438.       3929.       3295.       2769.       2324.       1951.       1638.       1375.       1154.
          969.         814.        683.        573.        481.        404.        339.        285.        239.        201.
          168.         141.        119.        100.         84.         70.         59.         50.         42.         35.
           29.          25.

        0                                           END-OF-PERIOD FLOW
   MO.DA   HR.MN  PERIOD    RAIN    EXCS    LOSS    COMP Q    MO.DA   HR.MN  PERIOD    RAIN    EXCS    LOSS    COMP Q

    1.01    1.00       1    0.14    0.07    0.07       90.     1.02   13.00      37    2.40    2.25    0.15    17542.
    1.01    2.00       2    0.14    0.07    0.07      333.     1.02   14.00      38    0.96    0.86    0.10    22235.
    1.01    3.00       3    0.14    0.07    0.07      617.     1.02   15.00      39    0.75    0.66    0.09    23870.
    1.01    4.00       4    0.14    0.08    0.07      868.     1.02   16.00      40    0.64    0.56    0.09    23190.
    1.01    5.00       5    0.15    0.08    0.07     1091.     1.02   17.00      41    0.57    0.49    0.08    22094.
    1.01    6.00       6    0.15    0.08    0.07     1291.     1.02   18.00      42    0.52    0.45    0.08    20861.
    1.01    7.00       7    0.15    0.09    0.07     1473.     1.02   19.00      43    0.49    0.41    0.07    19512.
    1.01    8.00       8    0.16    0.09    0.07     1639.     1.02   20.00      44    0.46    0.39    0.07    18401.
    1.01    9.00       9    0.16    0.09    0.07     1794.     1.02   21.00      45    0.43    0.36    0.07    17258.
    1.01   10.00      10    0.16    0.10    0.07     1939.     1.02   22.00      46    0.41    0.35    0.07    16196.
    1.01   11.00      11    0.17    0.10    0.07     2077.     1.02   23.00      47    0.40    0.33    0.07    15217.
    1.01   12.00      12    0.17    0.10    0.07     2211.     1.03    0.0       48    0.38    0.32    0.06    14322.
    1.01   13.00      13    0.17    0.11    0.07     2341.     1.03    1.00      49    0.26    0.20    0.05    13374.
    1.01   14.00      14    0.18    0.11    0.07     2470.     1.03    2.00      50    0.25    0.19    0.05    12284.
    1.01   15.00      15    0.18    0.12    0.07     2598.     1.03    3.00      51    0.24    0.18    0.05    11215.
    1.01   16.00      16    0.19    0.12    0.07     2729.     1.03    4.00      52    0.23    0.18    0.05    10274.
    1.01   17.00      17    0.19    0.13    0.07     2861.     1.03    5.00      53    0.22    0.17    0.05     9446.
    1.01   18.00      18    0.20    0.13    0.07     2996.     1.03    6.00      54    0.21    0.16    0.05     8717.
    1.01   19.00      19    0.21    0.14    0.07     3141.     1.03    7.00      55    0.20    0.16    0.05     8073.
    1.01   20.00      20    0.21    0.15    0.07     3290.     1.03    8.00      56    0.20    0.15    0.05     7505.
    1.01   21.00      21    0.22    0.15    0.07     3448.     1.03    9.00      57    0.19    0.15    0.05     7001.
    1.01   22.00      22    0.23    0.16    0.07     3616.     1.03   10.00      58    0.19    0.14    0.05     6553.
    1.01   23.00      23    0.24    0.17    0.07     3797.     1.03   11.00      59    0.18    0.14    0.04     6156.
    1.02    0.0       24    0.25    0.18    0.07     3992.     1.03   12.00      60    0.18    0.13    0.04     5802.
    1.02    1.00      25    0.37    0.29    0.08     4335.     1.03   13.00      61    0.17    0.13    0.04     5463.
    1.02    2.00      26    0.39    0.31    0.08     4912.     1.03   14.00      62    0.17    0.13    0.04     5203.
    1.02    3.00      27    0.41    0.32    0.08     5565.     1.03   15.00      63    0.16    0.12    0.04     4949.
    1.02    4.00      28    0.42    0.34    0.08     6188.     1.03   16.00      64    0.16    0.12    0.04     4720.
    1.02    5.00      29    0.45    0.36    0.08     6798.     1.03   17.00      65    0.16    0.12    0.04     4513.
    1.02    6.00      30    0.47    0.39    0.09     7411.     1.03   18.00      66    0.15    0.11    0.04     4324.
    1.02    7.00      31    0.51    0.42    0.09     8049.     1.03   19.00      67    0.15    0.11    0.04     4149.
    1.02    8.00      32    0.55    0.46    0.09     8736.     1.03   20.00      68    0.15    0.11    0.04     3984.
    1.02    9.00      33    0.60    0.51    0.09     9509.     1.03   21.00      69    0.15    0.11    0.04     3810.
    1.02   10.00      34    0.69    0.59    0.10    10430.     1.03   22.00      70    0.14    0.10    0.04     3683.
    1.02   11.00      35    0.83    0.73    0.10    11627.     1.03   23.00      71    0.14    0.10    0.04     3569.
    1.02   12.00      36    1.19    1.08    0.12    13491.     1.04    0.0       72    0.14    0.10    0.04     3467.

                                                                                SUM  24.01   19.21    4.79   538811.
                                                                                   ( 610.)( 488.)( 122.)(15257.45)

                              PEAK    6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
                     CFS    23870.    21605.     14915.      7459.        537033.
                     CMS      676.      617.       422.       211.         15207.
                  INCHES                4.48      12.25      18.38          18.38
                      MM              113.73     311.18     466.85         466.85
                AC-FT                   10312.    29584.    44383.            44383.
           THOUS CU M                   13337.    36491.    54746.            54746.


    **********          **********          **********          **********          **********

                                 SUB-AREA RUNOFF COMPUTATION

                       FLOOD HYDROGRAPH (ANDERSON AREA 2)

                             ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME   ISTAGE    IAUTO
                                 5         0         0         0         0         0         1        0        0
                                                  HYDROGRAPH DATA
              IHYDG      IUHG     TAREA     SNAP     TRSDA     TRSPC     RATIO     ISNOW     ISAME     LOCAL
                  1         0     29.20      0.0     29.20       0.0       0.0         0         0         0
                                                    PRECIP DATA
                   *TA        *PA       *TB       *PB      *TCC      *DUR          *N       *TF       *C1
                 60.00       2.40   1440.00     15.30     60.00     60.00          72   1440.00      0.41
                                                     LOSS DATA
         LROPT     STRKR     DLTKR     RTIOL     ERAIN     STRKS     RTIOK     STRTL     CNSTL     ALSMX     RTIMP
             0      0.15       0.0      3.50      0.40       0.0      1.00       0.0       0.0       0.0       0.0
                                             UNIT HYDROGRAPH DATA
                                       TC=  1.68      R=   5.15     NTA=   0
                                                   RECESSION DATA
                              STRTQ=      0.0      QRCSN=       0.0      RTIOR= 1.00
                              ACCUMULATED PRECIPITATION (INTERVAL = 60.00MIN)
                 0.0       2.40       3.59       4.55       5.33       6.13       6.82       7.46       8.06       8.64
                9.18       9.71      10.21      10.70      11.18      11.63      12.08      12.51      12.94      13.35
               13.76      14.15      14.54      14.93      15.30      15.56      15.81      16.06      16.30      16.53
               16.77      16.99      17.22      17.43      17.65      17.86      18.07      18.27      18.47      18.67
               18.86      19.06      19.25      19.43      19.62      19.80      19.98      20.15      20.33      20.50
               20.67      20.84      21.01      21.17      21.33      21.50      21.66      21.81      21.97      22.12
               22.28      22.43      22.58      22.73      22.87      23.02      23.16      23.31      23.45      23.59
               23.73      23.87      24.01

              UNIT HYDROGRAPH 29 END-OF-PERIOD ORDINATES, LAG=   2.01 HOURS, CP= 0.31   VOL= 1.00
           1060.       2539.       2697.       2219.       1826.       1503.       1237.       1018.        838.        690.
            568.        467.        384.        316.        260.        214.        176.        145.        119.         98.
             81.         67.         55.         45.         37.         31.         25.         21.         17.

      0                                          END-OF-PERIOD FLOW
  MO.DA   HR.MN   PERIOD    RAIN    EXCS    LOSS    COMP Q     MO.DA   HR.MN   PERIOD    RAIN    EXCS    LOSS     COMP
   1.01    1.00        1    0.14    0.07    0.07       74.      1.02   13.00       37    2.40    2.25    0.15     1216
   1.01    2.00        2    0.14    0.07    0.07      253.      1.02   14.00       38    0.96    0.86    0.10     1532
   1.01    3.00        3    0.14    0.07    0.07      449.      1.02   15.00       39    0.75    0.66    0.09    16095.
   1.01    4.00        4    0.14    0.08    0.07      619.      1.02   16.00       40    0.64    0.56    0.09    15446.
   1.01    5.00        5    0.15    0.08    0.07      768.      1.02   17.00       41    0.57    0.49    0.08    14555.
   1.01    6.00        6    0.15    0.08    0.07      899.      1.02   18.00       42    0.52    0.45    0.08     1361
   1.01    7.00        7    0.15    0.09    0.07     1017.      1.02   19.00       43    0.49    0.41    0.07     1266
   1.01    8.00        8    0.16    0.09    0.07     1124.      1.02   20.00       44    0.46    0.39    0.07     1180
   1.01    9.00        9    0.16    0.09    0.07     1223.      1.02   21.00       45    0.43    0.36    0.07     1099
   1.01   10.00       10    0.16    0.10    0.07     1315.      1.02   22.00       46    0.41    0.35    0.07    10257.
   1.01   11.00       11    0.17    0.10    0.07     1403.      1.02   23.00       47    0.40    0.33    0.07     9591.
   1.01   12.00       12    0.17    0.10    0.07     1488.      1.03    0.0        48    0.38    0.32    0.06     8989.
   1.01   13.00       13    0.17    0.11    0.07     1570.      1.03    1.00       49    0.26    0.20    0.05     834
   1.01   14.00       14    0.18    0.11    0.07     1652.      1.03    2.00       50    0.25    0.19    0.05     759
   1.01   15.00       15    0.18    0.12    0.07     1734.      1.03    3.00       51    0.24    0.18    0.05     689
   1.01   16.00       16    0.19    0.12    0.07     1817.      1.03    4.00       52    0.23    0.18    0.05     628
   1.01   17.00       17    0.19    0.13    0.07     1903.      1.03    5.00       53    0.22    0.17    0.05     5750.
   1.01   18.00       18    0.20    0.13    0.07     1991.      1.03    6.00       54    0.21    0.16    0.05     5288.
   1.01   19.00       19    0.21    0.14    0.07     2084.      1.03    7.00       55    0.20    0.16    0.05     4826
   1.01   20.00       20    0.21    0.15    0.07     2181.      1.03    8.00       56    0.20    0.15    0.05     453
   1.01   21.00       21    0.22    0.15    0.07     2285.      1.03    9.00       57    0.19    0.15    0.05     422
   1.01   22.00       22    0.23    0.16    0.07     2395.      1.03   10.00       58    0.19    0.14    0.05     395
   1.01   23.00       23    0.24    0.17    0.07     2514.      1.03   11.00       59    0.18    0.14    0.04     372
   1.02    0.0        24    0.25    0.18    0.07     2644.      1.03   12.00       60    0.18    0.13    0.04     3512.
   1.02    1.00       25    0.37    0.29    0.08     2891.      1.03   13.00       61    0.17    0.13    0.04     3325.
   1.02    2.00       26    0.39    0.31    0.08     3301.      1.03   14.00       62    0.17    0.13    0.04     3159.
   1.02    3.00       27    0.41    0.32    0.08     3746.      1.03   15.00       63    0.16    0.12    0.04     301
   1.02    4.00       28    0.42    0.34    0.08     4165.      1.03   16.00       64    0.16    0.12    0.04     287
   1.02    5.00       29    0.45    0.36    0.08     4572.      1.03   17.00       65    0.16    0.12    0.04     274
   1.02    6.00       30    0.47    0.39    0.09     4980.      1.03   18.00       66    0.15    0.11    0.04     261
   1.02    7.00       31    0.51    0.42    0.09     5404.      1.03   19.00       67    0.15    0.11    0.04     2523.
   1.02    8.00       32    0.55    0.46    0.09     5862.      1.03   20.00       68    0.15    0.11    0.04     2433.
   1.02    9.00       33    0.60    0.51    0.09     6383.      1.03   21.00       69    0.15    0.11    0.04     2362.
   1.02   10.00       34    0.69    0.59    0.10     7011.      1.03   22.00       70    0.14    0.10    0.04     229
   1.02   11.00       35    0.83    0.73    0.10     7840.      1.03   23.00       71    0.14    0.10    0.04     223
   1.02   12.00       36    1.19    1.03    0.12     9169.      1.04    0.0        72    0.14    0.10    0.04     217

                                                                                SUM  24.01   19.21    4.79   348996.
                                                                                   ( 610.)( 488.)( 122.)( 9882.48)

                              PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                  CFS       16095.     14576.      9716.      4832.       347877.
                  CMS         456.       413.       275.       137.         9851.
               INCHES                    4.64      12.38      18.47        18.47
                   MM                  117.94     314.49     469.15       469.15
                AC-FT                   7228.     19272.     28750.        28750.
           THOUS CU M                   8915.     23772.     35463.        35463.


    **********          **********          **********          **********          **********

                                      COMBINE HYDROGRAPHS

                       COMBINED HYDROGRAPH

                             ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME   ISTAGE    IAUTO
                                 6         3         0         0         0         0         1        0        0

                                     SUM OF 3 HYDROGRAPHS AT      6
        174.       595.      1073.      1504.      1886.      2238.      2569.      2889.      3206.      3527.
       3855.      4194.      4547.      4915.      5258.      5593.      6117.      6538.      7144.      7747.
       8380.      9036.      9715.     10417.     11384.     12759.     14297.     15810.     17325.     18876.
      20507.     22273.     24249.     26582.     29461.     33533.     41755.     50839.     54737.     55179.
      55304.     55578.     56113.     56912.     57351.     58819.     59655.     60224.     60138.     59411.
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 58230.     56869.     55358.     53720.     51976.     50157.     48285.     46386.     44482.     42598.
 40761.     38975.     37250.     35590.     34007.     32506.     31106.     29776.     28494.     27313.
 26209.     25202.

                     PEAK     6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
          CFS       60224.    59389.     53755.     28134.      2025612.
          CMS        1705.     1682.      1522.       797.        57357.
       INCHES                  2.84      10.29      16.16         16.16
           MM                 72.22     261.47     410.54        410.54
        AC-FT                 29449.    106621.    167406.       167406.
  THOUS CU M                  36325.    131515.    206492.       206492.


   **********         **********         **********         **********         **********

                                   HYDROGRAPH ROUTING

                      ANDERSON FLOOD ROUTING
                        ISTAQ    ICOMP    IECON    ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                            7        1        0        0       0       0       1       0       0
                                              ROUTING DATA
                 QLOSS  CLOSS      AVG     IRES    ISAME    IOPT    IPMP                  LSTR
                   0.0    0.0     1.00        1        0       0       0                     0
                        NSTPS    NSTDL      LAG    AMSKK       X     TSK   STORA  ISPRAT
                            1        0        0      0.0     0.0     0.0     -1.      -1

 STORAGE       0.0      6370.00    13070.00    20080.00    20810.00    21550.00    22300.00    23050.00    23800.00
 OUTFLOW       0.0      8120.00    22970.00    42200.00    43800.00    46700.00    50450.00    54900.00    59950.00

                          0
                       MO.DA   HR.MN   PERIOD   EOP STOR    AVG IN   EOP OUT    STAGE   AVG PUMP

                        1.01    1.00      1       136.       174.      174.      0.0       0.
                        1.01    2.00      2       170.       595.      216.      0.0       0.
                        1.01    3.00      3       237.      1078.      302.      0.0       0.
                        1.01    4.00      4       332.      1504.      423.      0.0       0.
                        1.01    5.00      5       442.      1885.      559.      0.0       0.
                        1.01    6.00      6       577.      2235.      736.      0.0       0.
                        1.01    7.00      7       721.      2559.      920.      0.0       0.
                        1.01    8.00      8       876.      2869.     1117.      0.0       0.
                        1.01    9.00      9      1040.      3200.     1326.      0.0       0.
                        1.01   10.00     10      1213.      3537.     1546.      0.0       0.
                        1.01   11.00     11      1384.      3855.     1777.      0.0       0.
                        1.01   12.00     12      1564.      4155.     2019.      0.0       0.
                        1.01   13.00     13      1762.      4547.     2272.      0.0       0.
                        1.01   14.00     14      1990.      4915.     2537.      0.0       0.
                        1.01   15.00     15      2207.      5268.     2813.      0.0       0.
                        1.01   16.00     16      2433.      5695.     3102.      0.0       0.
                        1.01   17.00     17      2670.      6117.     3403.      0.0       0.
                        1.01   18.00     18      2920.      6539.     3722.      0.0       0.
                        1.01   19.00     19      3169.      7147.     4065.      0.0       0.
                        1.01   20.00     20      3478.      7747.     4433.      0.0       0.
                        1.01   21.00     21      3763.      8360.     4828.      0.0       0.
                        1.01   22.00     22      4118.      9055.     5249.      0.0       0.
                        1.01   23.00     23      4459.      9715.     5696.      0.0       0.
                        1.02    0.0      24      4830.     10417.     6169.      0.0       0.
                        1.02    1.00     25      5249.     11184.     6691.      0.0       0.
                        1.02    2.00     26      5725.     12559.     7298.      0.0       0.
                        1.02    3.00     27      6275.     14027.     7993.      0.0       0.
                        1.02    4.00     28      6869.     15910.     9227.      0.0       0.
                        1.02    5.00     29      7482.     17335.    10585.      0.0       0.
                        1.02    6.00     30      8110.     18878.    11977.      0.0       0.
                        1.02    7.00     31      8753.     20507.    13408.      0.0       0.
                        1.02    8.00     32      9427.     22479.    14895.      0.0       0.
                        1.02    9.00     33     10135.     24549.    16465.      0.0       0.
                        1.02   10.00     34     10901.     26562.    18163.      0.0       0.
                        1.02   11.00     35     11758.     29451.    20062.      0.0       0.
                        1.02   12.00     36     12765.     33658.    22340.      0.0       0.
                        1.02   13.00     37     14053.     41755.    26159.      0.0       0.
                        1.02   14.00     38     16055.     50837.    31185.      0.0       0.
                        1.02   15.00     39     17813.     54737.    35981.      0.0       0.
                        1.02   16.00     40     19838.     55179.    39890.      0.0       0.
                        1.02   17.00     41     20396.     55304.    42876.      0.0       0.
                        1.02   18.00     42     21318.     55578.    45790.      0.0       0.
                        1.02   19.00     43     22035.     56113.    49117.      0.0       0.
                        1.02   20.00     44     22559.     56812.    51987.      0.0       0.
                        1.02   21.00     45     22949.     57651.    54296.      0.0       0.
                        1.02   22.00     46     23243.     58519.    56201.      0.0       0.
                        1.02   23.00     47     23467.     59555.    57705.      0.0       0.
                        1.03    0.0      48     23629.     60224.    58601.      0.0       0.
                        1.03    1.00     49     23719.     60183.    59405.      0.0       0.
                        1.03    2.00     50     23719.     59330.    59408.      0.0       0.
                        1.03    3.00     51     23643.     58230.    58595.      0.0       0.
                        1.03    4.00     52     23512.     56869.    58013.      0.0       0.
                        1.03    5.00     53     23341.     55358.    56657.      0.0       0.
                        1.03    6.00     54     23137.     53720.    55401.      0.0       0.
                        1.03    7.00     55     22907.     51976.    54051.      0.0       0.
                        1.03    8.00     56     22648.     50157.    52517.      0.0       0.
                        1.03    9.00     57     22357.     48285.    50850.      0.0       0.
                        1.03   10.00     58     22054.     46386.    49099.      0.0       0.
                        1.03   11.00     59     21735.     44482.    47630.      0.0       0.
                        1.03   12.00     60     21385.     42598.    46054.      0.0       0.
                        1.03   13.00     61     21009.     40761.    44579.      0.0       0.
                        1.03   14.00     62     20587.     38975.    43333.      0.0       0.
                        1.03   15.00     63     20136.     37250.    42323.      0.0       0.
                        1.03   16.00     64     19635.     35590.    40990.      0.0       0.
                        1.03   17.00     65     19118.     34007.    39530.      0.0       0.
                        1.03   18.00     66     18584.     32506.    38123.      0.0       0.
                        1.03   19.00     67     18073.     31106.    36594.      0.0       0.
                        1.03   20.00     68     17559.     29776.    35095.      0.0       0.
                        1.03   21.00     69     17055.     28494.    33803.      0.0       0.
                        1.03   22.00     70     16556.     27313.    32561.      0.0       0.
                        1.03   23.00     71     16095.     26209.    31258.      0.0       0.
                        1.04    0.0      72     15644.     25202.    30032.      0.0       0.

                                                          SUM      1865583.
                                                               (   52827.51)

                     PEAK     6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
          CFS       59408.    58534.     51455.     25911.      1865583.
          CMS        1682.     1650.      1458.       734.        52828.
       INCHES                  2.81       9.86      14.77         14.77
           MM                 71.30     250.48     375.05        375.05
        AC-FT                 29075.    102136.    152932.       152932.
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167000

181518

El. < 643'

STORAGE = 91280
+ 23719
114,999 ac-ft

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RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
                     AREA IN SQUARE MILES(SQUARE KILOMETERS)

                                   PEAK     6-HOUR     24-HOUR    72-HOUR      AREA
   HYDROGRAPH AT          1       43905.     42929.     35095.     17745.     119.80
                           (  1243.25)(  1215.62)(   993.78)(   502.48)(   310.28)

   ROUTED TO              2       40837.     40286.     34077.     16399.     119.80
                           (  1156.37)(  1140.78)(   964.97)(   464.36)(   310.28)

   ROUTED TO              3       40314.     39764.     33874.     15843.     119.80
                           (  1141.58)(  1126.00)(   959.20)(   448.63)(   310.28)

   HYDROGRAPH AT          4       23870.     21805.     14915.      7459.      45.30
                           (   675.92)(   617.44)(   422.35)(   211.21)(   117.33)

   HYDROGRAPH AT          5       16095.     14576.      9716.      4832.      29.20
                           (   455.75)(   412.74)(   275.13)(   136.82)(    75.63)

    3-COMBINED            6       60224.     59389.     53755.     28134.     194.30
                           (  1705.36)(  1681.72)(  1522.17)(   796.65)(   503.24)

   ROUTED TO              7       59408.     58634.     51495.     25701.     194.30
                           (  1682.24)(  1660.32)(  1458.17)(   727.77)(   503.24)
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                 DWR - - DIVISION OF SAFETY OF DAMS
            PROGRAM HEC-1M - MODULE CREATED AND TESTED 8/79 .
                           APRIL     20, 1981

A                   LEROY ANDERSON DAM 72-9 SWANSON    1
1                   HMR 36 72 HOURS STORM
2                   HYDROGRAPH ANALYSIS                0       0       0       0
B     72       1       0       0       0       0
I      3                                               1
K      0       1       0       0       0       0
1                    FLOOD HYDROGRAPH (COYOTE RES )
                               0               0      .8
M      1       0   119.8           119.8                    1440     .41
P     60     2.4    1440    15.3      60      60      72
T    .15       0     3.5      .4
V  10.58   10.71
X      0       0       1               0       1
K      1       2       0       0       0
1                   COYOTE RES FLOOD ROUTING
Y                      1       1
1      0       0       0       0       0       0      -1      -1
2      1       0                7300    9200   11100   13000   15000   17200
                    3600    5400
3      0    1800                                           32300   39500   47100
                    4900    9100   14000   19500   25700
K      0    1700
                       0       0       0       0       1
1      1       3
Y                   CHANEL ROUTING
                       0       0
1      0       0                                      -1
                       0    2.08      .2       0
K      1       0                                       1
                       0       0       0       0
1      0       4
M                   FLOOD HYDROGRAPH ( ANDERSON AREA)
                    45.3       0    45.3       0      .8
P      1       0                      60      60      72    1440     .41
T     60     2.4    1440    15.3
V    .15       0     3.5      .4
X   1.85    5.73
K      0       0       1       0       0       0       1
1      0       5       0
M                    FLOOD HYDROGRAPH (ANDERSON AREA 2)
                    29.2       0    29.2       0      .8
P      1       0                                            1440     .41
T     60     2.4    1440    15.3      60      60      72
V    .15       0       0     3.5      .4
X   1.68    5.15
K      0       0       1       0       0       0       1
1      3       6       0
K                   COMBINING HYDROGRAPH
1              7       0       0       3       0       1
       1
1         ANDERSON FLOOD ROUTING 90 % HMR 36 START RES ELEV 569
Y      0       0       0       1       0       0      -1      -1
1      1       0       0       0   31430   51430   57670   64364   71377   72852
2      0    1430   11430   21430
2  74347   75862                                    8623   13567   42709   47200
3      0     437     444     460     472     500
3  55402   66027
K     99
END
```

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                 DWR - - DIVISION OF SAFETY OF DAMS
           PROGRAM HEC-1M - MODULE CREATED AND TESTED 8/79

                         APRIL     20, 1981

                   LEROY ANDERSON DAM 72-9 SWANSON
                   HMR 36 72 HOURS STORM
                   HYDROGRAPH ANALYSIS

                                 JOB SPECIFICATION
      NQ      NHR      NMIN      IDAY      IHR      IMIN    METRC     IPLT     IPRT   NSTAN
      72        1         0         0        0         0        0        0        0       0
                                JOPER      NWT     LROPT    TRACE
                                    3        0         0        0

**********        **********        **********        **********        **********

                         SUB-AREA RUNOFF COMPUTATION

                     FLOOD HYDROGRAPH (COYOTE RES )

              ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                  1        0        0        0        0        0        1        0        0

                                    HYDROGRAPH DATA
        IHYDG    IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
            1       0   119.80      0.0   119.80      0.0    0.800        0        0        0

                                      PRECIP DATA
           *TA      *RA      *TB      *PB     *TCC     *DUR       *N      *TF      *C1
         60.00     2.40  1440.00    15.30    60.00    60.00       72  1440.00     0.41

                                       LOSS DATA
   LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
       0    0.15     0.0    3.50    0.40     0.0    1.00     0.0     0.0     0.0     0.0

                               UNIT HYDROGRAPH DATA
                    TC= 10.50      R= 10.71      NTA=  0

                                  RECESSION DATA
                STRTQ=    0.0     QRCSN=     0.0     RTIOR= 1.00

                 ACCUMULATED PRECIPITATION (INTERVAL = 60.00MIN)
      0.0      2.40      3.59      4.55      5.38      6.13      6.82      7.45      8.06      8.64
      9.18      9.71     10.21     10.70     11.18     11.63     12.08     12.51     12.94     13.35
     13.76     14.15     14.54     14.93     15.30     15.55     15.81     16.06     16.30     16.53
     16.77     16.99     17.22     17.43     17.65     17.86     18.07     18.27     18.47     18.67
     18.86     19.05     19.25     19.43     19.62     19.80     19.98     20.15     20.33     20.50
     20.67     20.84     21.01     21.17     21.33     21.50     21.66     21.81     21.97     22.12
     22.28     22.43     22.58     22.73     22.87     23.02     23.16     23.31     23.45     23.59
     23.73     23.87     24.01

     UNIT HYDROGRAPH 63 END-OF-PERIOD ORDINATES, LAG=   9.65 HOURS, CP= 0.57  VOL= 1.00
      142.      530.     1077.     1713.     2408.     3118.     3744.     4211.     4513.     4635.
     4503.     4164.     3792.     3454.     3146.     2855.     2610.     2377.     2165.     1972.
     1796.     1636.     1490.     1357.     1235.     1126.     1025.      934.      850.      775.
      705.      643.      585.      533.      485.      442.      403.      367.      334.      304.
      277.      252.      230.      209.      191.      174.      158.      144.      131.      120.
      109.       99.       90.       82.       75.       68.       62.       57.       52.       47.
       43.       39.       35.

                                      END-OF-PERIOD FLOW
     0
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q    MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

  1.01   1.00       1   0.14   0.07   0.07      10.     1.02  13.00      37   2.40   2.25   0.15    20148.
  1.01   2.00       2   0.14   0.07   0.07      47.     1.02  14.00      38   0.96   0.86   0.10    22840.
  1.01   3.00       3   0.14   0.07   0.07     123.     1.02  15.00      39   0.75   0.66   0.09    25969.
  1.01   4.00       4   0.14   0.08   0.07     247.     1.02  16.00      40   0.64   0.55   0.09    29344.
  1.01   5.00       5   0.15   0.08   0.07     423.     1.02  17.00      41   0.57   0.49   0.08    32801.
  1.01   6.00       6   0.15   0.08   0.07     654.     1.02  18.00      42   0.52   0.45   0.08    36135.
  1.01   7.00       7   0.15   0.09   0.07     938.     1.02  19.00      43   0.49   0.41   0.07    39071.
  1.01   8.00       8   0.16   0.09   0.07    1253.     1.02  20.00      44   0.46   0.39   0.07    41397.
  1.01   9.00       9   0.16   0.09   0.07    1622.     1.02  21.00      45   0.43   0.36   0.07    43026.
  1.01  10.00      10   0.16   0.10   0.07    2002.     1.02  22.00      46   0.41   0.35   0.07    43886.
  1.01  11.00      11   0.17   0.10   0.07    2386.     1.02  23.00      47   0.40   0.33   0.07    43905.
  1.01  12.00      12   0.17   0.10   0.07    2761.     1.03   0.0       48   0.38   0.32   0.06    43250.
  1.01  13.00      13   0.17   0.11   0.07    3124.     1.03   1.00      49   0.25   0.20   0.05    42260.
  1.01  14.00      14   0.18   0.11   0.07    3478.     1.03   2.00      50   0.25   0.19   0.05    41101.
  1.01  15.00      15   0.18   0.12   0.07    3824.     1.03   3.00      51   0.24   0.18   0.05    39819.
  1.01  16.00      16   0.19   0.12   0.07    4165.     1.03   4.00      52   0.23   0.18   0.05    38446.
  1.01  17.00      17   0.19   0.13   0.07    4502.     1.03   5.00      53   0.22   0.17   0.05    36993.
  1.01  18.00      18   0.20   0.13   0.07    4837.     1.03   6.00      54   0.21   0.16   0.05    35492.
  1.01  19.00      19   0.21   0.14   0.07    5173.     1.03   7.00      55   0.20   0.16   0.05    33943.
  1.01  20.00      20   0.21   0.15   0.07    5511.     1.03   8.00      56   0.20   0.15   0.05    32389.
  1.01  21.00      21   0.22   0.15   0.07    5854.     1.03   9.00      57   0.19   0.15   0.05    30839.
  1.01  22.00      22   0.23   0.16   0.07    6204.     1.03  10.00      58   0.19   0.14   0.05    29318.
  1.01  23.00      23   0.24   0.17   0.07    6563.     1.03  11.00      59   0.18   0.14   0.04    27854.
  1.02   0.0       24   0.25   0.18   0.07    6933.     1.03  12.00      60   0.18   0.13   0.04    26471.
  1.02   1.00      25   0.37   0.29   0.08    7333.     1.03  13.00      61   0.17   0.13   0.04    25170.
  1.02   2.00      26   0.39   0.31   0.08    7793.     1.03  14.00      62   0.17   0.13   0.04    23949.
  1.02   3.00      27   0.41   0.32   0.08    8329.     1.03  15.00      63   0.16   0.12   0.04    22803.
  1.02   4.00      28   0.42   0.34   0.08    8956.     1.03  16.00      64   0.16   0.12   0.04    21726.
  1.02   5.00      29   0.45   0.36   0.09    9687.     1.03  17.00      65   0.16   0.12   0.04    20717.
  1.02   6.00      30   0.47   0.39   0.09   10530.     1.03  18.00      66   0.15   0.11   0.04    19771.
  1.02   7.00      31   0.51   0.42   0.09   11486.     1.03  19.00      67   0.15   0.11   0.04    18884.
  1.02   8.00      32   0.55   0.46   0.09   12552.     1.03  20.00      68   0.15   0.11   0.04    18054.
  1.02   9.00      33   0.60   0.51   0.09   13727.     1.03  21.00      69   0.15   0.11   0.04    17275.
  1.02  10.00      34   0.69   0.59   0.10   15019.     1.03  22.00      70   0.14   0.10   0.04    16547.
  1.02  11.00      35   0.83   0.73   0.10   16442.     1.03  23.00      71   0.14   0.10   0.04    15865.
  1.02  12.00      36   1.19   1.08   0.12   18064.     1.04   0.0       72   0.14   0.10   0.04    15223.

                                                                 SUM   24.01  19.21   4.79  1285257.
                                                                     ( 610.)( 488.)( 122.)(36394.43)

                      PEAK   6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
           CFS      43905.   42929.    35095.    17745.      1277533.
           CMS       1243.    1216.      994.      502.        36179.
        INCHES                3.33     10.90     16.55         16.55
            MM               84.67    276.87    419.97        419.97
         AC-FT               21287.    69610.   105589.       105589.
   THOUS CU M                26257.    85863.   130243.       130243.
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                                                   RUNOFF MULTIPLIED BY 0.80
          8.          38.          99.         197.         338.         524.         750.        1011.        1298.        1601.
       1909.        2209.        2500.        2782.        3059.        3332.        3601.        3870.        4138.        4409.
       4683.        4963.        5251.        5548.        5868.        6235.        6663.        7165.        7749.        8424.
       9189.       10041.       10982.       12015.       13154.       14451.       16119.       18272.       20775.       23475.
      26241.       28909.       31257.       33118.       34421.       35109.       35124.       34600.       33808.       32880.
      31856.       30757.       29599.       28394.       27158.       25911.       24671.       23454.       22283.       21177.
      20136.       19159.       18242.       17361.       16573.       15816.       15107.       14443.       13820.       13237.
      12691.       12179.

                                  PEAK      6-HOUR      24-HOUR      72-HOUR   TOTAL VOLUME
                         CFS    35124.      34343.       28076.       14196.       1022110.
                         CMS      995.        972.         795.         402.         28943.
                      INCHES                  2.67         8.72        13.23          13.23
                          MM                 67.73       221.50       335.98         335.98
                       AC-FT                17030.       55688.       84472.         84472.
                  THOUS CU M                21006.       68690.      104195.        104195.



          **********          **********          **********          **********          **********

                                               HYDROGRAPH ROUTING

                                    COYOTE RES FLOOD ROUTING
                                 ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME    ISTAGE     IAUTO
                                     2         1         0         0         0         0         1         0         0
                                                      ROUTING DATA
                       QLOSS     CLOSS       AVG      IRES     ISAME      IOPT      IPMP                LSTR
                         0.0       0.0      1.00         1         0         0         0                   0

                                 NSTPS     NSTDL       LAG     AMSKK         X       TSK     STORA    ISPRAT
                                     1         0         0       0.0       0.0       0.0       -1.        -1

 STORAGE        0.0      1800.00      3600.00      5400.00      7300.00      9200.00     11100.00     13000.00     15000.00     172
 OUTFLOW        0.0      1700.00      4900.00      9100.00     14000.00     19500.00     25700.00     32300.00     39500.00     471

                                      0
                                 MO.DA    HR.MN    PERIOD   EOP STOR     AVG IN    EOP OUT      STAGE   AVG PUMP

                                  1.01     1.00         1         8.         8.         8.        0.0         0.
                                  1.01     2.00         2        11.        38.        10.        0.0         0.
                                  1.01     3.00         3        18.        99.        17.        0.0         0.
                                  1.01     4.00         4        32.       197.        30.        0.0         0.
                                  1.01     5.00         5        57.       338.        53.        0.0         0.
                                  1.01     6.00         6        94.       524.        89.        0.0         0.
                                  1.01     7.00         7       147.       750.       138.        0.0         0.
                                  1.01     8.00         8       216.      1011.       204.        0.0         0.
                                  1.01     9.00         9       303.      1298.       286.        0.0         0.
                                  1.01    10.00        10       408.      1601.       385.        0.0         0.
                                  1.01    11.00        11       529.      1909.       499.        0.0         0.
                                  1.01    12.00        12       665.      2209.       628.        0.0         0.
                                  1.01    13.00        13       814.      2500.       768.        0.0         0.
                                  1.01    14.00        14       974.      2782.       920.        0.0         0.
                                  1.01    15.00        15      1144.      3059.      1080.        0.0         0.
                                  1.01    16.00        16      1323.      3332.      1250.        0.0         0.
                                  1.01    17.00        17      1510.      3601.      1426.        0.0         0.
                                  1.01    18.00        18      1704.      3870.      1610.        0.0         0.
                                  1.01    19.00        19      1902.      4138.      1882.        0.0         0.
                                  1.01    20.00        20      2097.      4409.      2228.        0.0         0.
                                  1.01    21.00        21      2286.      4683.      2564.        0.0         0.
                                  1.01    22.00        22      2471.      4963.      2892.        0.0         0.
                                  1.01    23.00        23      2652.      5251.      3215.        0.0         0.
                                  1.02      0.0        24      2832.      5548.      3534.        0.0         0.
                                  1.02     1.00        25      3011.      5868.      3854.        0.0         0.
                                  1.02     2.00        26      3195.      6235.      4180.        0.0         0.
                                  1.02     3.00        27      3386.      6663.      4519.        0.0         0.
                                  1.02     4.00        28      3590.      7165.      4882.        0.0         0.
                                  1.02     5.00        29      3806.      7749.      5381.        0.0         0.
                                  1.02     6.00        30      4035.      8424.      5916.        0.0         0.
                                  1.02     7.00        31      4282.      9189.      6491.        0.0         0.
                                  1.02     8.00        32      4550.     10041.      7116.        0.0         0.
                                  1.02     9.00        33      4841.     10982.      7796.        0.0         0.
                                  1.02    10.00        34      5159.     12015.      8538.        0.0         0.
                                  1.02    11.00        35      5506.     13154.      9374.        0.0         0.
                                  1.02    12.00        36      5885.     14451.     10352.        0.0         0.
                                  1.02    13.00        37      6316.     16119.     11462.        0.0         0.
                                  1.02    14.00        38      6825.     18272.     12774.        0.0         0.
                                  1.02    15.00        39      7421.     20775.     14349.        0.0         0.
                                  1.02    16.00        40      8094.     23475.     16299.        0.0         0.
                                  1.02    17.00        41      8828.     26241.     18424.        0.0         0.
                                  1.02    18.00        42      9597.     28909.     20795.        0.0         0.
                                  1.02    19.00        43     10359.     31257.     23281.        0.0         0.
                                  1.02    20.00        44     11075.     33118.     25618.        0.0         0.
                                  1.02    21.00        45     11711.     34421.     27824.        0.0         0.
                                  1.02    22.00        46     12238.     35109.     29653.        0.0         0.
                                  1.02    23.00        47     12633.     35124.     31026.        0.0         0.
                                  1.03      0.0        48     12892.     34600.     31923.        0.0         0.
                                  1.03     1.00        49     13028.     33808.     32399.        0.0         0.
                                  1.03     2.00        50     13062.     32880.     32524.        0.0         0.
                                  1.03     3.00        51     13014.     31856.     32351.        0.0         0.
                                  1.03     4.00        52     12899.     30757.     31949.        0.0         0.
                                  1.03     5.00        53     12729.     29599.     31359.        0.0         0.
                                  1.03     6.00        54     12515.     28394.     30615.        0.0         0.
                                  1.03     7.00        55     12265.     27158.     29747.        0.0         0.
                                  1.03     8.00        56     11988.     25911.     28784.        0.0         0.
                                  1.03     9.00        57     11691.     24671.     27751.        0.0         0.
                                  1.03    10.00        58     11380.     23454.     26673.        0.0         0.
                                  1.03    11.00        59     11062.     22283.     25578.        0.0         0.
                                  1.03    12.00        60     10742.     21177.     24532.        0.0         0.
                                  1.03    13.00        61     10422.     20136.     23487.        0.0         0.
                                  1.03    14.00        62     10107.     19159.     22459.        0.0         0.
                                  1.03    15.00        63      9800.     18242.     21457.        0.0         0.
                                  1.03    16.00        64      9503.     17361.     20488.        0.0         0.
                                  1.03    17.00        65      9218.     16573.     19558.        0.0         0.
                                  1.03    18.00        66      8942.     15816.     18753.        0.0         0.
                                  1.03    19.00        67      8673.     15107.     17974.        0.0         0.
                                  1.03    20.00        68      8412.     14443.     17219.        0.0         0.
                                  1.03    21.00        69      8161.     13820.     16493.        0.0         0.
                                  1.03    22.00        70      7921.     13237.     15797.        0.0         0.
                                  1.03    23.00        71      7692.     12691.     15133.        0.0         0.
                                  1.04      0.0        72      7473.     12179.     14502.        0.0         0.

                                                                   SUM      945121.
                                                                        (  26762.69)
                         PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
             CFS       32524.    32056.    27136.    13026.        937866.
             CMS         921.      908.      768.      369.         26557.
          INCHES                   2.49      8.43     12.14          12.14
              MM                  63.22    214.08    308.29         308.29
           AC-FT                 15896.    53823.    77510.         77510.
      THOUS CU M                 19607.    66390.    95607.         95607.


  **********          **********          **********          **********          **********

                                   HYDROGRAPH ROUTING

                CHANEL ROUTING
                       ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME    ISTAGE     IAUTO
                           3         1         0         0         0         0         1         0         0
                                           ROUTING DATA
              QLOSS    CLOSS       AVG      IRES     ISAME      IOPT      IPMP                 LSTR
                0.0    0.0       0.0           0         0         0         0                    0

                       NSTPS     NSTDL       LAG    AMSKK         X       TSK     STORA    ISPRAT
                           1         0         0    2.000     0.200     0.0        -1.         0

                                 ROUTED FLOWS AT         3
        8.        8.        9.       13.       22.       38.       63.      101.      152.      218.
      299.      397.      509.      635.      773.      922.     1080.     1247.     1425.     1650.
     1930.     2235.     2551.     2870.     3190.     3509.     3832.     4164.     4515.     4936.
     5411.     5955.     6507.     7131.     7614.     8572.     9433.    10424.    11571.    12951.
    14570.    16443.    18550.    20827.    23127.    25365.    27401.    29111.    30429.    31344.
    31883.    32083.    31998.    31674.    31151.    30465.    29648.    28730.    27737.    26698.
    25657.    24614.    23579.    22561.    21567.    20607.    19720.    18884.    18086.    17323.
    16592.    15894.

                         PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
             CFS       32083.    31629.    26975.    12575.        905402.
             CMS         909.      896.      764.      356.         25638.
          INCHES                   2.46      8.38     11.72          11.72
              MM                  62.38    212.81    297.62         297.62
           AC-FT                 15684.    53503.    74827.         74827.
      THOUS CU M                 19345.    65996.    92297.         92297.


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                                   SUB-AREA RUNOFF COMPUTATION

                FLOOD HYDROGRAPH ( ANDERSON AREA)

                       ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME    ISTAGE     IAUTO
                           4         0         0         0         0         0         1         0         0
                                           HYDROGRAPH DATA
            IHYDG     IUHG    TAREA      SNAP     TRSDA     TRSPC     RATIO     ISNOW     ISAME     LOCAL
                1        0    45.30      0.0      45.30       0.0     0.800         0         0         0
                                            PRECIP DATA
              *TA         *RA       *TB       *PB      *TCC      *DUR         *N       *TF        *C1
            60.00        2.40   1440.00     15.30     60.00     60.00         72   1440.00      0.41
                                             LOSS DATA
       LROPT    STRKR     DLTKR     RTIOL     ERAIN     STRKS     RTICK     STRTL     CNSTL     ALSMX     RTIMP
           0     0.15      0.0       3.50      0.40      0.0       1.00      0.0       0.0       0.0       0.0
                                         UNIT HYDROGRAPH DATA
                                  TC=   1.86      R=   5.73     NTA=   0
                                           RECESSION DATA
                        STRTQ=      0.0       QRCSN=      0.0       RTIOR= 1.00
                         ACCUMULATED PRECIPITATION (INTERVAL = 60.00MIN)
           0.0       2.40      3.59      4.55      5.38      6.13      6.82      7.46      8.06      8.64
           9.18      9.71     10.21     10.70     11.18     11.63     12.08     12.51     12.94     13.35
          13.76     14.15     14.54     14.93     15.30     15.56     15.81     16.06     16.30     16.53
          16.77     16.99     17.22     17.43     17.65     17.86     18.07     18.27     18.47     18.67
          18.86     19.06     19.25     19.43     19.62     19.80     19.98     20.15     20.33     20.50
          20.67     20.84     21.01     21.17     21.33     21.50     21.66     21.81     21.97     22.12
          22.28     22.43     22.58     22.73     22.87     23.02     23.16     23.31     23.45     23.59
          23.73     23.87     24.01
          UNIT HYDROGRAPH 32 END-OF-PERIOD ORDINATES, LAG=   2.24 HOURS, CP= 0.32   VOL= 1.00
    1302.     3438.     3929.     3293.     2769.     2324.     1951.     1638.     1375.     1154.
     969.      814.      683.      573.      481.      404.      339.      285.      239.      201.
     168.      141.      119.      100.       84.       70.       59.       50.       42.       35.
      29.       25.
       0                                      END-OF-PERIOD FLOW
  MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q

   1.01   1.00       1   0.14   0.07   0.07      90.      1.02  13.00      37   2.40   2.25   0.15   17542.
   1.01   2.00       2   0.14   0.07   0.07     333.      1.02  14.00      38   0.96   0.86   0.10   22236.
   1.01   3.00       3   0.14   0.07   0.07     617.      1.02  15.00      39   0.75   0.66   0.09   23870.
   1.01   4.00       4   0.14   0.08   0.07     868.      1.02  16.00      40   0.64   0.56   0.09   23190.
   1.01   5.00       5   0.15   0.08   0.07    1091.      1.02  17.00      41   0.57   0.49   0.08   22094.
   1.01   6.00       6   0.15   0.08   0.07    1291.      1.02  18.00      42   0.52   0.45   0.08   20661.
   1.01   7.00       7   0.15   0.09   0.07    1473.      1.02  19.00      43   0.49   0.41   0.07   19612.
   1.01   8.00       8   0.16   0.09   0.07    1639.      1.02  20.00      44   0.46   0.39   0.07   18401.
   1.01   9.00       9   0.16   0.09   0.07    1794.      1.02  21.00      45   0.43   0.36   0.07   17258.
   1.01  10.00      10   0.16   0.10   0.07    1939.      1.02  22.00      46   0.41   0.35   0.07   16196.
   1.01  11.00      11   0.17   0.10   0.07    2077.      1.02  23.00      47   0.40   0.33   0.07   15217.
   1.01  12.00      12   0.17   0.10   0.07    2211.      1.03   0.0       48   0.38   0.32   0.06   14322.
   1.01  13.00      13   0.17   0.11   0.07    2341.      1.03   1.00      49   0.26   0.20   0.05   13374.
   1.01  14.00      14   0.18   0.11   0.07    2470.      1.03   2.00      50   0.25   0.19   0.05   12284.
   1.01  15.00      15   0.18   0.12   0.07    2598.      1.03   3.00      51   0.24   0.18   0.05   11215.
   1.01  16.00      16   0.19   0.12   0.07    2729.      1.03   4.00      52   0.23   0.18   0.05   10274.
   1.01  17.00      17   0.19   0.13   0.07    2861.      1.03   5.00      53   0.22   0.17   0.05    9445.
   1.01  18.00      18   0.20   0.13   0.07    2998.      1.03   6.00      54   0.21   0.16   0.05    8717.
   1.01  19.00      19   0.21   0.14   0.07    3141.      1.03   7.00      55   0.20   0.16   0.05    8073.
   1.01  20.00      20   0.21   0.15   0.07    3290.      1.03   8.00      56   0.20   0.15   0.05    7505.
   1.01  21.00      21   0.22   0.15   0.07    3448.      1.03   9.00      57   0.19   0.15   0.05    7001.
   1.01  22.00      22   0.23   0.16   0.07    3616.      1.03  10.00      58   0.19   0.14   0.05    6553.
   1.01  23.00      23   0.24   0.17   0.07    3797.      1.03  11.00      59   0.18   0.14   0.04    6155.
   1.02   0.0       24   0.25   0.18   0.07    3992.      1.03  12.00      60   0.18   0.13   0.04    5802.
   1.02   1.00      25   0.37   0.29   0.08    4335.      1.03  13.00      61   0.17   0.13   0.04    5485.
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 1.02   2.00        26   0.39   0.31   0.08      4912.            1.03  14.00        62   0.17   0.13   0.04      5203.
 1.02   3.00        27   0.41   0.32   0.08      5565.            1.03  15.00        63   0.16   0.12   0.04      4949.
 1.02   4.00        28   0.42   0.34   0.08      6188.            1.03  16.00        64   0.16   0.12   0.04      4720.
 1.02   5.00        29   0.45   0.36   0.09      6798.            1.03  17.00        65   0.16   0.12   0.04      4513.
 1.02   6.00        30   0.47   0.39   0.09      7411.            1.03  18.00        66   0.15   0.11   0.04      4324.
 1.02   7.00        31   0.51   0.42   0.09      8049.            1.03  19.00        67   0.15   0.11   0.04      4149.
 1.02   8.00        32   0.55   0.46   0.09      8736.            1.03  20.00        68   0.15   0.11   0.04      3984.
 1.02   9.00        33   0.60   0.51   0.09      9509.            1.03  21.00        69   0.15   0.11   0.04      3810.
 1.02  10.00        34   0.69   0.59   0.10     10430.            1.03  22.00        70   0.14   0.10   0.04      3683.
 1.02  11.00        35   0.83   0.73   0.10     11627.            1.03  23.00        71   0.14   0.10   0.04      3569.
 1.02  12.00        36   1.19   1.08   0.12     13491.            1.04   0.0         72   0.14   0.10   0.04      3467.

                                                                                 SUM  24.01  19.21   4.79   538811.
                                                                                    ( 610.)( 488.)( 122.)(15257.45)

                          PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                 CFS    23670.     21805.     14915.      7459.       537033.
                 CMS      676.       617.       422.       211.        15207.
              INCHES                 4.43      12.25      18.38         18.38
                  MM               113.73     311.18     466.85        466.85
               AC-FT                10812.     29564.     44383.        44383.
          THOUS CU M                13337.     36491.     54746.        54746.

                                   RUNOFF MULTIPLIED BY 0.80
        72.       266.       494.       695.       873.      1033.      1178.      1311.      1435.      1551.
      1662.      1769.      1873.      1976.      2079.      2183.      2289.      2399.      2513.      2632.
      2758.      2893.      3037.      3194.      3468.      3929.      4452.      4951.      5436.      5929.
      6439.      6969.      7607.      8344.      9301.     10793.     14034.     17789.     19096.     18552.
     17675.     16689.     15689.     14721.     13807.     12957.     12174.     11458.     10700.      9828.
      8972.      8219.      7557.      6973.      6459.      6004.      5601.      5243.      4925.      4642.
      4389.      4163.      3959.      3776.      3610.      3459.      3320.      3187.      3048.      2946.
      2856.      2774.

                          PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                 CFS    19096.     17444.     11932.      5967.       429627.
                 CMS      541.       494.       338.       169.        12166.
              INCHES                 3.58       9.80      14.70         14.70
                  MM                90.93     248.94     373.48        373.48
               AC-FT                 8650.     23667.     35506.        35506.
          THOUS CU M                10669.     29193.     43796.        43796.


    **********          **********          **********          **********          **********

                              SUB-AREA RUNOFF COMPUTATION

                          FLOOD HYDROGRAPH (ANDERSON AREA 2)

                   ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       5       0       0       0       0       0       1       0       0

                                        HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1       0   29.20     0.0   29.20     0.0   0.800       0       0       0

                                          PRECIP DATA
             *TA      *RA     *TB     *RB    *TCC    *DUR          *N     *TF     *C1
           60.00     2.40 1440.00   15.30   60.00   60.00          72 1440.00    0.41

                                           LOSS DATA
      LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
          0    0.15     0.0    1.00    3.50    0.40    1.00     0.0     0.0     0.0     0.0

                                     UNIT HYDROGRAPH DATA
                              TC=  1.68     R=  5.15    NTA=   0

                                         RECESSION DATA
                        STRTQ=     0.0     QRCSN=     0.0      RTIOR= 1.00

                         ACCUMULATED PRECIPITATION (INTERVAL = 60.00MIN)
           0.0       2.40       3.59       4.55       5.38       6.13       6.82       7.46       8.06       8.64
           9.18       9.71      10.21      10.70      11.18      11.63      12.08      12.51      12.94      13.35
          13.76      14.15      14.54      14.93      15.30      15.56      15.81      16.06      16.30      16.53
          16.77      16.99      17.22      17.43      17.65      17.86      18.07      18.27      18.47      18.67
          18.85      19.06      19.25      19.43      19.62      19.80      19.98      20.15      20.33      20.50
          20.67      20.84      21.01      21.17      21.33      21.50      21.66      21.81      21.97      22.12
          22.28      22.43      22.58      22.73      22.87      23.02      23.16      23.31      23.45      23.59
          23.73      23.87      24.01

         UNIT HYDROGRAPH 29 END-OF-PERIOD ORDINATES, LAG=   2.01 HOURS, CP= 0.31  VOL= 1.00
      1060.      2539.      2697.      2219.      1826.      1503.      1237.      1018.       838.       690.
       568.       467.       384.       316.       260.       214.       176.       145.       119.        98.
        81.        67.        55.        45.        37.        31.        25.        21.        17.

                                              END-OF-PERIOD FLOW
     0
 MO.DA   HR.MN   PERIOD    RAIN    EXCS    LOSS    COMP Q      MO.DA   HR.MN   PERIOD    RAIN    EXCS    LOSS    COMP Q

  1.01    1.00        1    0.14    0.14    0.00      145.       1.02   13.00       37    2.40    0.00    2.40    10294.
  1.01    2.00        2    0.14    0.14    0.00      496.       1.02   14.00       38    0.96    0.83    0.13     9904.
  1.01    3.00        3    0.14    0.14    0.00      874.       1.02   15.00       39    0.75    0.69    0.05    10266.
  1.01    4.00        4    0.14    0.14    0.00     1193.       1.02   16.00       40    0.64    0.61    0.03    10752.
  1.01    5.00        5    0.15    0.15    0.00     1465.       1.02   17.00       41    0.57    0.55    0.02    10858.
  1.01    6.00        6    0.15    0.15    0.00     1697.       1.02   18.00       42    0.52    0.51    0.02    10771.
  1.01    7.00        7    0.15    0.15    0.00     1898.       1.02   19.00       43    0.49    0.48    0.01    10549.
  1.01    8.00        8    0.16    0.16    0.00     2072.       1.02   20.00       44    0.46    0.45    0.01    10257.
  1.01    9.00        9    0.16    0.16    0.00     2227.       1.02   21.00       45    0.43    0.43    0.01     9927.
  1.01   10.00       10    0.16    0.16    0.00     2365.       1.02   22.00       46    0.41    0.41    0.01     9582.
  1.01   11.00       11    0.17    0.17    0.00     2490.       1.02   23.00       47    0.40    0.39    0.01     9236.
  1.01   12.00       12    0.17    0.17    0.00     2606.       1.03    0.0        48    0.38    0.38    0.01     8895.
  1.01   13.00       13    0.17    0.17    0.00     2714.       1.03    1.00       49    0.26    0.26    0.00     8456.
  1.01   14.00       14    0.18    0.18    0.00     2817.       1.03    2.00       50    0.25    0.25    0.00     7873.
  1.01   15.00       15    0.18    0.18    0.00     2917.       1.03    3.00       51    0.24    0.24    0.00     7221.
  1.01   16.00       16    0.19    0.19    0.00     3015.       1.03    4.00       52    0.23    0.23    0.00     6777.
  1.01   17.00       17    0.19    0.19    0.00     3114.       1.03    5.00       53    0.22    0.22    0.00     6325.
  1.01   18.00       18    0.20    0.20    0.00     3213.       1.03    6.00       54    0.21    0.21    0.00     5923.
  1.01   19.00       19    0.21    0.21    0.00     3316.       1.03    7.00       55    0.20    0.20    0.00     5558.
  1.01   20.00       20    0.21    0.21    0.00     3422.       1.03    8.00       56    0.20    0.20    0.00     5253.
  1.01   21.00       21    0.22    0.22    0.00     3534.       1.03    9.00       57    0.19    0.19    0.00     4973.
  1.01   22.00       22    0.23    0.23    0.00     3652.       1.03   10.00       58    0.19    0.19    0.00     4722.
  1.01   23.00       23    0.24    0.24    0.00     3779.       1.03   11.00       59    0.18    0.18    0.00     4499.
  1.02    0.0        24    0.25    0.25    0.00     3917.       1.03   12.00       60    0.18    0.18    0.00     4298.
  1.02    1.00       25    0.37    0.37    0.00     4180.       1.03   13.00       61    0.17    0.17    0.00     4116.
  1.02    2.00       26    0.39    0.38    0.01     4615.       1.03   14.00       62    0.17    0.17    0.00     3952.
  1.02    3.00       27    0.41    0.40    0.01     5065.       1.03   15.00       63    0.16    0.16    0.00     3803.
  1.02    4.00       28    0.42    0.42    0.01     5524.       1.03   16.00       64    0.16    0.16    0.00     3666.
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                                   STOR         IN          OUT

1.01  21.00       21     6514.      7267.        441.        0.0        0.
1.01  22.00       22     7121.      7783.        441.        0.0        0.
1.01  23.00       23     7773.      8331.        441.        0.0        0.
1.02   0.0        24     8472.      8905.        442.        0.0        0.
1.02   1.00       25     9229.      9599.        442.        0.0        0.
1.02   2.00       26    10065.     10566.        443.        0.0        0.
1.02   3.00       27    10999.     11742.        444.        0.0        0.
1.02   4.00       28    12032.     12943.        445.        0.0        0.
1.02   5.00       29    13162.     14122.        447.        0.0        0.
1.02   6.00       30    14392.     15332.        449.        0.0        0.
1.02   7.00       31    15729.     16618.        451.        0.0        0.
1.02   8.00       32    17179.     18000.        453.        0.0        0.
1.02   9.00       33    18754.     19518.        455.        0.0        0.
1.02  10.00       34    20472.     21235.        458.        0.0        0.
1.02  11.00       35    22357.     23274.        461.        0.0        0.
1.02  12.00       36    24461.     25920.        464.        0.0        0.
1.02  13.00       37    26857.     29577.        467.        0.0        0.
1.02  14.00       38    29532.     33921.        470.        0.0        0.
1.02  15.00       39    32692.     37508.        474.        0.0        0.
1.02  16.00       40    35916.     39482.        478.        0.0        0.
1.02  17.00       41    39224.     40511.        483.        0.0        0.
1.02  18.00       42    42601.     41344.        488.        0.0        0.
1.02  19.00       43    46049.     42214.        492.        0.0        0.
1.02  20.00       44    49560.     43216.        497.        0.0        0.
1.02  21.00       45    53111.     44315.       2683.        0.0        0.
1.02  22.00       46    56463.     45433.       7052.        0.0        0.
1.02  23.00       47    59556.     46477.      10047.        0.0        0.
1.03   0.0        48    62587.     47325.      12255.        0.0        0.
1.03   1.00       49    65308.     47739.      17488.        0.0        0.
1.03   2.00       50    67437.     47682.      26338.        0.0        0.
1.03   3.00       51    68900.     47079.      32417.        0.0        0.
1.03   4.00       52    69873.     46206.      36458.        0.0        0.
1.03   5.00       53    70487.     45170.      39011.        0.0        0.
1.03   6.00       54    70839.     44000.      40474.        0.0        0.
1.03   7.00       55    70998.     42725.      41134.        0.0        0.
1.03   8.00       56    71014.     41353.      41202.        0.0        0.  — peak
1.03   9.00       57    70926.     39949.      40835.        0.0        0.
1.03  10.00       58    70760.     38488.      40147.        0.0        0.
1.03  11.00       59    70539.     37005.      39226.        0.0        0.
1.03  12.00       60    70277.     35519.      38140.        0.0        0.
1.03  13.00       61    69989.     34058.      36943.        0.0        0.
1.03  14.00       62    69686.     32639.      35582.        0.0        0.
1.03  15.00       63    69374.     31250.      34380.        0.0        0.
1.03  16.00       64    69059.     29925.      33073.        0.0        0.
1.03  17.00       65    68746.     28639.      31777.        0.0        0.
1.03  18.00       66    68438.     27412.      30498.        0.0        0.
1.03  19.00       67    68139.     26259.      29255.        0.0        0.
1.03  20.00       68    67852.     25181.      28061.        0.0        0.
1.03  21.00       69    67576.     24155.      26915.        0.0        0.
1.03  22.00       70    67313.     23187.      25823.        0.0        0.
1.03  23.00       71    67064.     22282.      24785.        0.0        0.
1.04   0.0        72    66827.     21424.      23800.        0.0        0.

                                    SUM     844539.
                                         (  23914.71)

              PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
      CFS    41202.    40485.     32838.     11563.         832541.
      CMS     1167.     1146.       930.       327.          23575.
   INCHES                1.94       6.29       6.64            6.64
       MM               49.23     159.73     168.74          168.74
    AC-FT               20075.     65132.     68805.          68805.
THOUS CU M              24762.     80340.     84870.          84870.
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 1.02   5.00        29   0.45   0.44   0.01       5946.         1.03  17.00        65   0.16   0.16   0.00       3539.
 1.02   6.00        30   0.47   0.46   0.01       6362.         1.03  18.00        66   0.15   0.15   0.00       3436.
 1.02   7.00        31   0.51   0.49   0.01       6789.         1.03  19.00        67   0.15   0.15   0.00       3330.
 1.02   8.00        32   0.55   0.53   0.02       7245.         1.03  20.00        68   0.15   0.15   0.00       3234.
 1.02   9.00        33   0.60   0.58   0.03       7754.         1.03  21.00        69   0.15   0.15   0.00       3146.
 1.02  10.00        34   0.69   0.65   0.04       8350.         1.03  22.00        70   0.14   0.14   0.00       3066.
 1.02  11.00        35   0.83   0.75   0.08       9097.         1.03  23.00        71   0.14   0.14   0.00       2992.
 1.02  12.00        36   1.19   0.92   0.28      10102.         1.04   0.0         72   0.14   0.14   0.00       2924.

                                                                             SUM  24.01  20.78   3.22   374451.
                                                                                ( 610.)( 528.)(  82.)(10603.29)

                         PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
              CFS      10868.     10549.      8897.      5179.       372916.
              CMS        308.       299.       252.       147.        10560.
           INCHES                   3.36      11.34      19.80         19.80
               MM                  85.36     287.97     502.92        502.92
            AC-FT                  5231.     17647.     30819.        30819.
       THOUS CU M                  6452.     21767.     38015.        38015.

                                     RUNOFF MULTIPLIED BY 0.80
     116.      397.      699.      955.     1172.     1358.     1518.     1658.     1781.     1892.
    1992.     2085.     2171.     2254.     2334.     2412.     2491.     2571.     2653.     2738.
    2827.     2922.     3023.     3133.     3244.     3662.     4068.     4419.     4757.     5090.
    5431.     5795.     6203.     6660.     7278.     8082.     8235.     7923.     8212.     8601.
    8644.     8617.     8439.     8206.     7942.     7686.     7538.     7117.     6765.     6298.
    5832.     5422.     5060.     4739.     4455.     4202.     3978.     3778.     3599.     3438.
    3293.     3162.     3042.     2933.     2831.     2749.     2664.     2587.     2517.     2453.
    2394.     2339.

                         PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
              CFS       8694.      8439.      7118.      4144.       298332.
              CMS        246.       239.       202.       117.         8448.
           INCHES                   2.69       9.07      15.84         15.84
               MM                  68.29     230.33     402.34        402.34
            AC-FT                  4185.     14118.     24656.        24656.
       THOUS CU M                  5162.     17414.     30412.        30412.


   **********          **********          **********          **********          **********

                                          COMBINE HYDROGRAPHS

                              COMBINING HYDROGRAPH
                          ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME   ISTAGE     IAUTO
                              6         3         0         0         0         0         1        0         0

                                     SUM OF 3 HYDROGRAPHS AT      6
     197.      671.     1202.     1663.     2067.     2429.     2760.     3070.     3368.     3661.
    3953.     4250.     4553.     4864.     5185.     5517.     5860.     6217.     6590.     7019.
    7515.     8050.     8612.     9197.    10001.    11131.    12352.    13534.    14710.    15954.
   17281.    18719.    20317.    22155.    24395.    27447.    31707.    36135.    38879.    40084.
   40939.    41749.    42679.    43754.    44675.    45991.    46964.    47686.    47893.    47470.
   46687.    45724.    44615.    43386.    42064.    40671.    39227.    37750.    36260.    34778.
   33339.    31939.    30581.    29270.    28008.    26815.    25703.    24658.    23652.    22722.
   21842.    21006.

                         PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
              CFS      47893.     47093.     42033.     22685.      1633352.
              CMS       1356.      1334.      1190.       642.        46251.
           INCHES                   2.25       8.05      13.03         13.03
               MM                  57.27     204.46     331.04        331.04
            AC-FT                 23352.     83370.    134988.       134988.
       THOUS CU M                 28804.    102836.    166505.       166505.


   **********          **********          **********          **********          **********

                                          HYDROGRAPH ROUTING
                ANDERSON FLOOD ROUTING 80 % HMR 36 START RES ELEV 569
                          ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME   ISTAGE     IAUTO
                              7         1         0         0         3         0         1        0         0
                                                     ROUTING DATA
                   QLOSS    CLOSS      AVG      IRES     ISAME      IOPT      IPMP               LSTR
                     0.0    0.0        0.0         1         0         0         0                  0

                          NSTPS     NSTDL       LAG     AMSKK       X         TSK     STORA   ISPRAT
                              1         0         0     0.0     0.0       0.0         -1.       -1

 STORAGE          0.0       1430.00      11430.00      21430.00      31430.00      51430.00      57670.00      64364.00      71377.00      72
             74347.00      75862.00

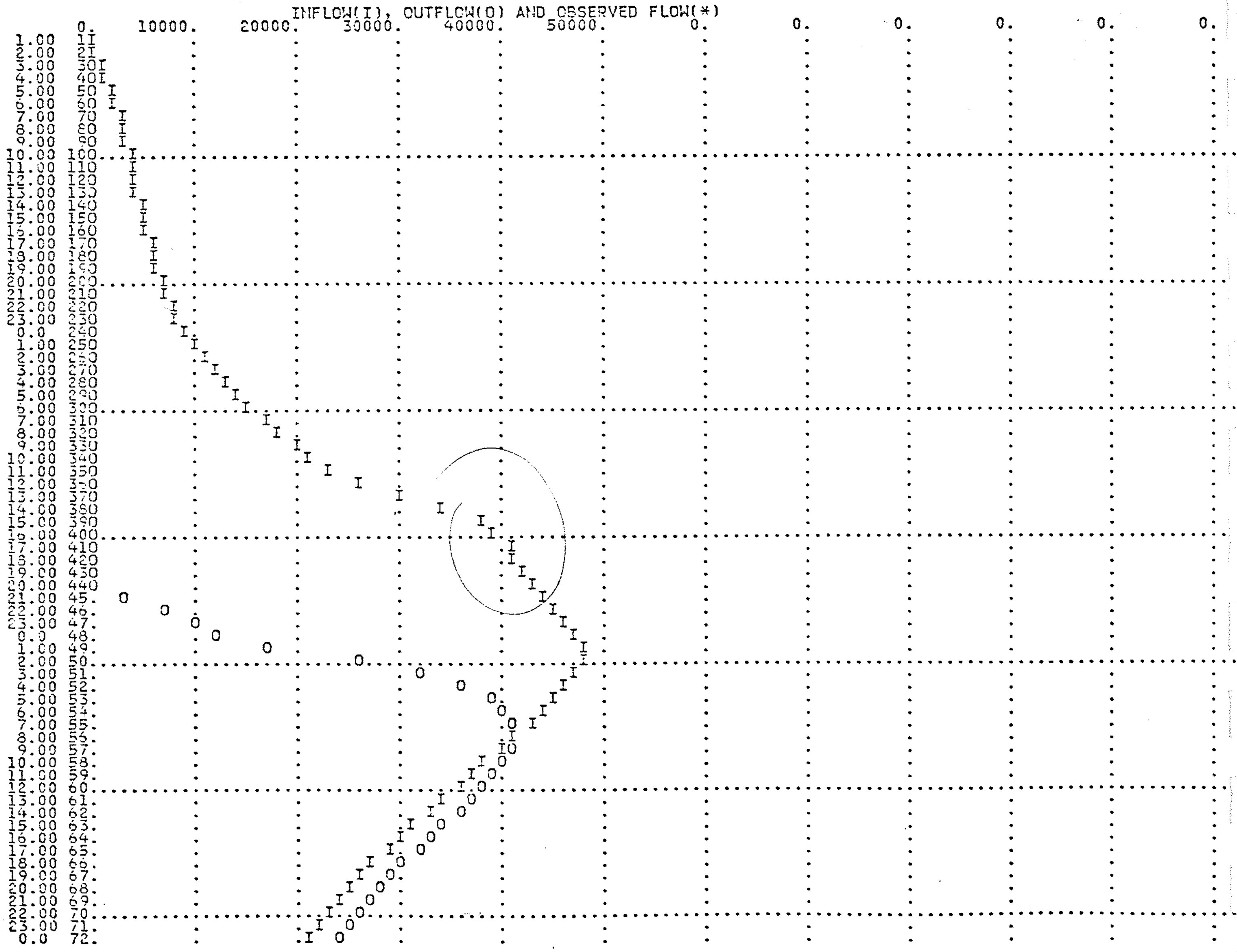
 OUTFLOW          0.0        437.00        444.00        460.00        472.00        500.00       8623.00      13567.00      42709.00      47
             55402.00      66027.00

                               0
                          MO.DA    HR.MN   PERIOD   EOP STOR     AVG IN   EOP OUT      STAGE   AVG PUMP

                           1.01     1.00        1       643.       197.      197.        0.0         0.
                           1.01     2.00        2       662.       434.      202.        0.0         0.
                           1.01     3.00        3       722.       937.      221.        0.0         0.
                           1.01     4.00        4       821.      1432.      251.        0.0         0.
                           1.01     5.00        5       953.      1865.      291.        0.0         0.
                           1.01     6.00        6      1113.      2248.      340.        0.0         0.
                           1.01     7.00        7      1297.      2594.      396.        0.0         0.
                           1.01     8.00        8      1503.      2915.      437.        0.0         0.
                           1.01     9.00        9      1733.      3219.      437.        0.0         0.
                           1.01    10.00       10      1987.      3514.      437.        0.0         0.
                           1.01    11.00       11      2266.      3807.      438.        0.0         0.
                           1.01    12.00       12      2569.      4102.      438.        0.0         0.
                           1.01    13.00       13      2895.      4402.      438.        0.0         0.
                           1.01    14.00       14      3249.      4709.      438.        0.0         0.
                           1.01    15.00       15      3628.      5025.      439.        0.0         0.
                           1.01    16.00       16      4034.      5351.      439.        0.0         0.
                           1.01    17.00       17      4465.      5688.      439.        0.0         0.
                           1.01    18.00       18      4931.      6038.      439.        0.0         0.
                           1.01    19.00       19      5424.      6403.      440.        0.0         0.
                           1.01    20.00       20      5950.      6805.      440.        0.0         0.
```

OVF

STATION 7



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RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
                      AREA IN SQUARE MILES(SQUARE KILOMETERS)

                                  PEAK     6-HOUR    24-HOUR    72-HOUR      AREA
  HYDROGRAPH AT            1    35124.     34343.     28076.     14196.    119.80
                            (   994.60)(   972.49)(   795.03)(   401.99)(   310.28)

  ROUTED TO                2    32524.     32056.     27136.     13026.    119.80
                            (   920.98)(   907.74)(   768.40)(   368.85)(   310.28)

  ROUTED TO                3    32083.     31629.     26975.     12575.    119.80
                            (   908.50)(   895.63)(   763.84)(   356.09)(   310.28)

  HYDROGRAPH AT            4    19096.     17444.     11932.      5967.     45.30
                            (   540.73)(   493.95)(   337.88)(   168.97)(   117.33)

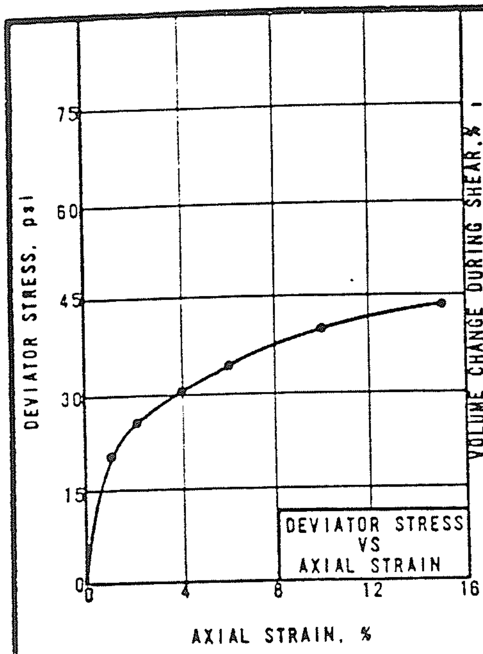
  HYDROGRAPH AT            5     8694.      8439.      7118.      4144.     29.20
                            (   246.19)(   238.97)(   201.55)(   117.33)(    75.63)

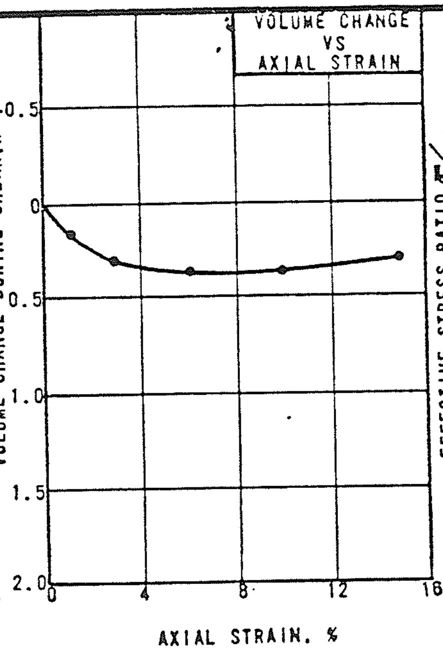
   3-COMBINED              6    47893.     47093.     42033.     22685.    194.30
                            (  1356.19)(  1333.52)(  1190.23)(   642.38)(   503.24)

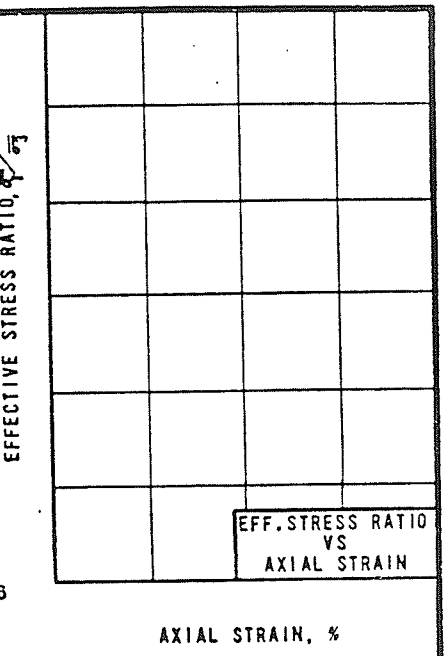
  ROUTED TO                7    41202.     40485.     32838.     11563.    194.30
                            (  1166.72)(  1146.41)(   929.86)(   327.43)(   503.24)
```

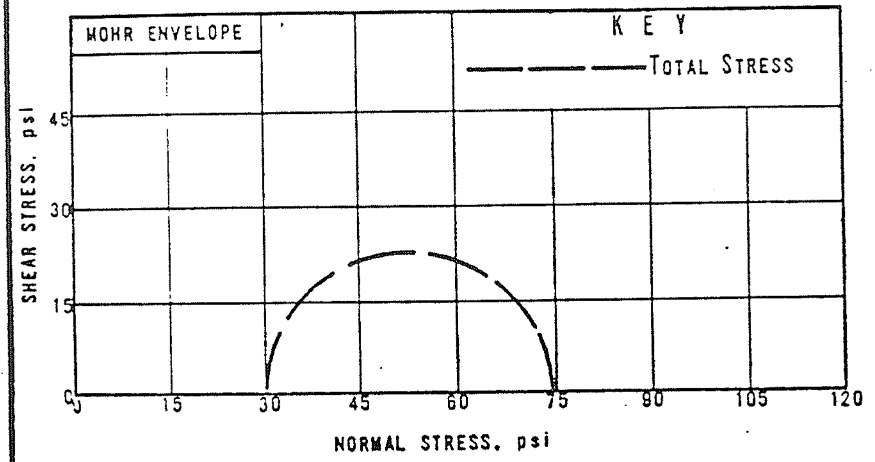
APPENDIX D

Soil Test Results

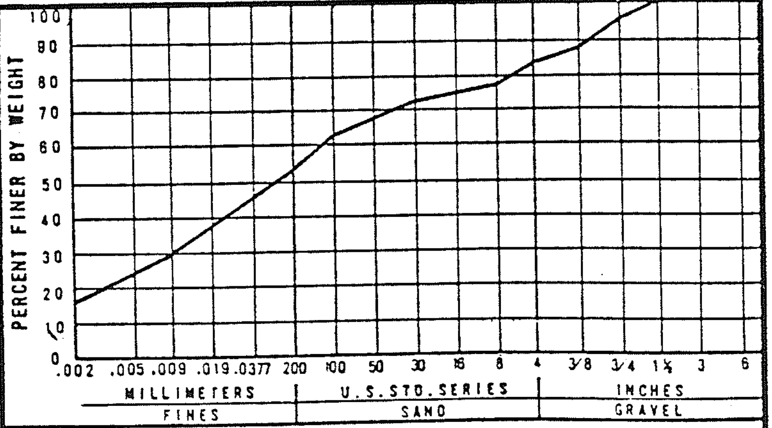








SPECIMEN NO.				
INITIAL CONDITION	Water Content, %	18.9		
	Opt. Water Content, %	---		
	Dry Density, pcf	111.0		
	Max. Dry Density, pcf	---		
	Void Ratio	0.518		
	Saturation, %	98.7		
FINAL CONDITION	Confin. Pressure, psi	30.0		
	"B" Parameter	0.48		
	Volume Change Prior to Shear, %	1.6		
	Void Ratio	---		
	Saturation, %	---		
GENERAL	Specimen Diameter, in.	2.875		
	Back Pressure, psi	0		
	Time Test, hr.	1.95		
	Rate of Strain, %/hr.	7.69		

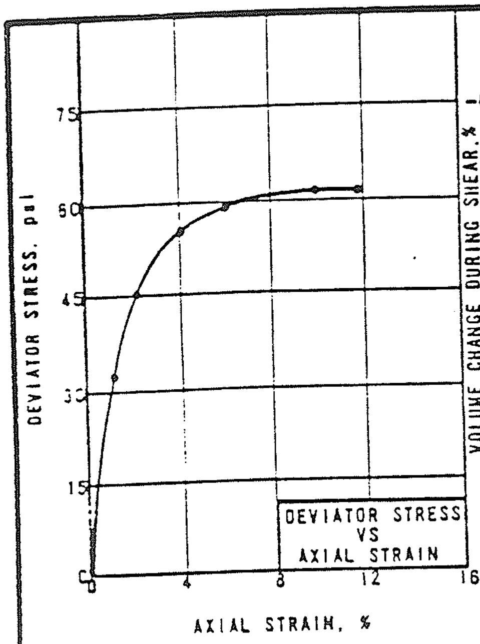


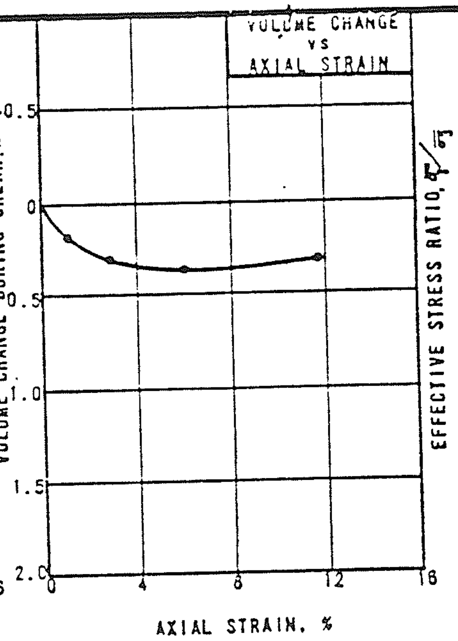
SYMB	CL	SOIL CLASSIFICATION: BROWN, GRAVELLY, SANDY CLAY
LL	37	
PL	21	SAMPLE LOCATION: HOLE AD-1, PB-4, 55-57.5 FEET
PI	16	
SG	2.7 (EST)	NOTE:

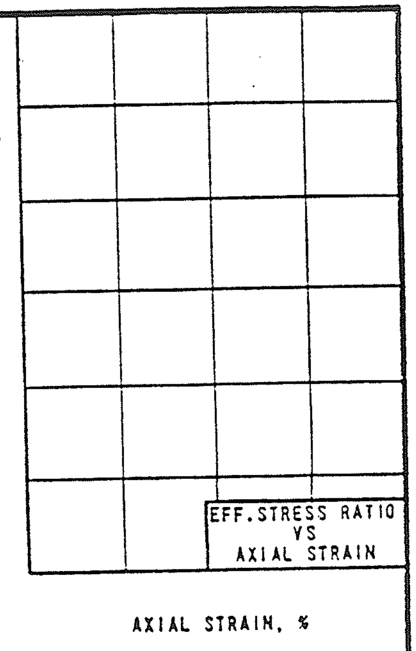
834(REV)

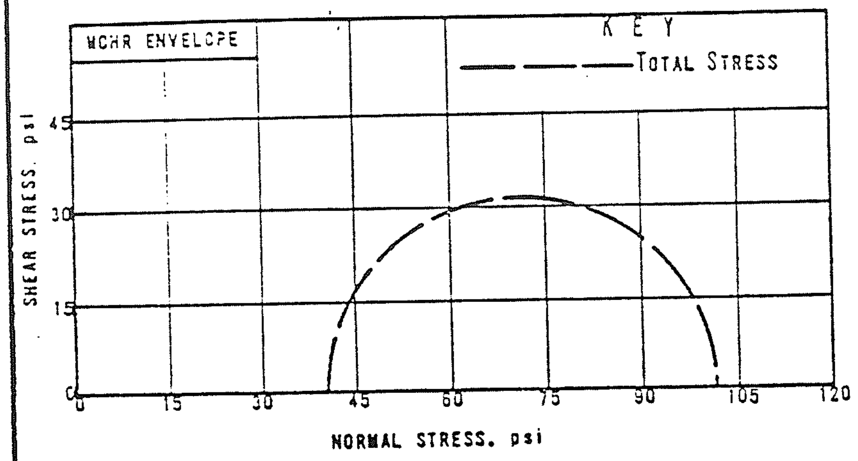
W.A. WAHLER & ASSOCIATES	ANDERSON DAM	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS		SAMPLE NO.
		PROJECT NO.	DATE	SHEET NO.
PALO ALTO · NEWPORT BEACH · CALIF.		0746A	DECEMBER 1975	FIGURE 8-3	AD-1, PB-4

Sheet 1 of 7

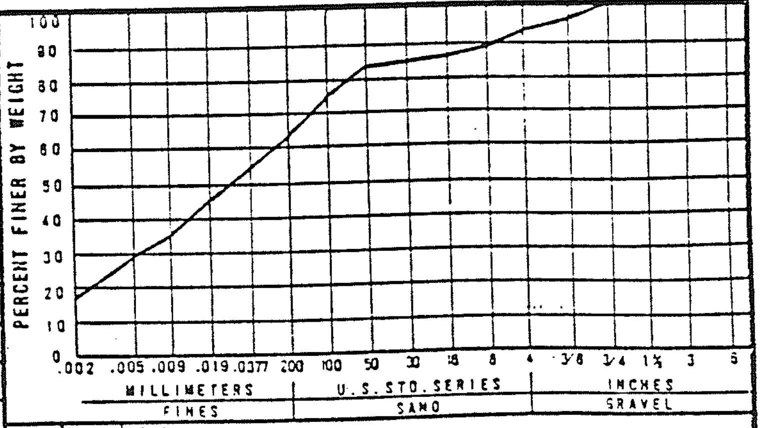








SPECIMEN NO.				
INITIAL CONDITION	Water Content, %	17.1		
	Opt. Water Content, %	---		
	Dry Density pcf	115.2		
	Max. Dry Density, pcf	---		
	Void Ratio	0.463		
	Saturation, %	100.0		
FINAL CONDITION	Confin. Pressure, psi	40.0		
	"B" Parameter	0.37		
	Volume Change Prior to Shear, %	1.1		
	Void Ratio	---		
	Saturation, %	---		
GENERAL	Specimen Diameter, in.	2.875		
	Back Pressure, psi	0		
	Time Test, hr.	1.52		
	Rate of Strain, %/hr.	7.69		



SYMB	CL	SOIL CLASSIFICATION: BROWN, SANDY CLAY
LL	45	
PL	21	SAMPLE LOCATION: HOLE AD-1, PB-6, 74-78.5 FEET
PI	24	
SG	2.7 (EST)	NOTE:

W. A. WAHLER & ASSOCIATES

PALO ALTO · NEWPORT BEACH · CALIF.

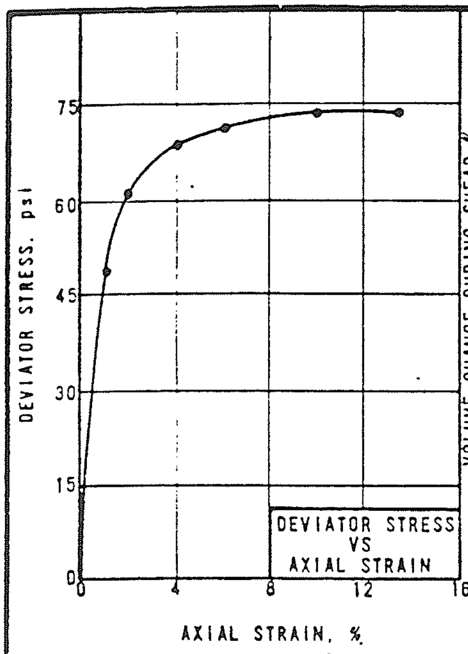
ANDERSON DAM

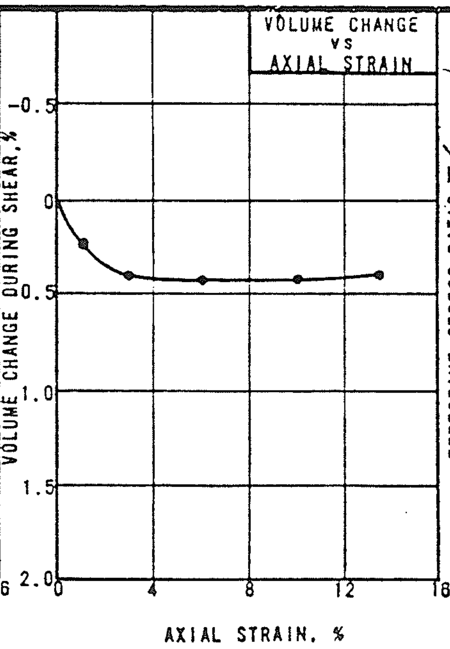
UNCONSOLIDATED UNDRAINED
TRIAXIAL TEST RESULTS

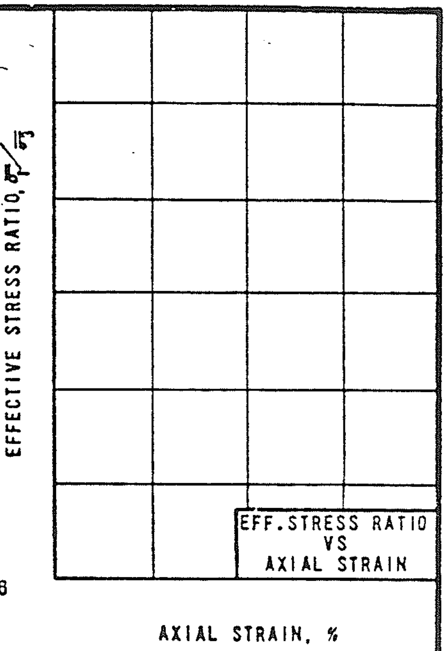
PROJECT NO.	DATE	SHEET NO.	SAMPLE NO.
0746A	DECEMBER 1975	FIGURE 8-3	AD-1, PB-6

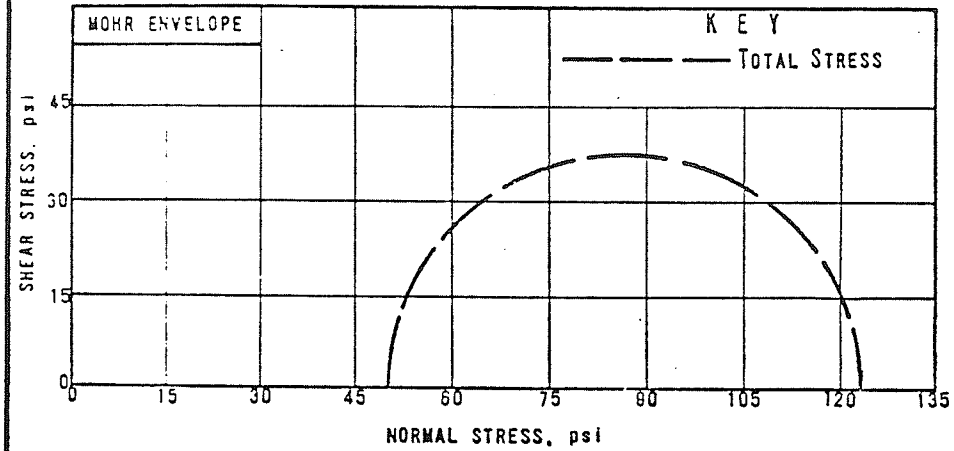
034(REV)

Sheet 2 of 7

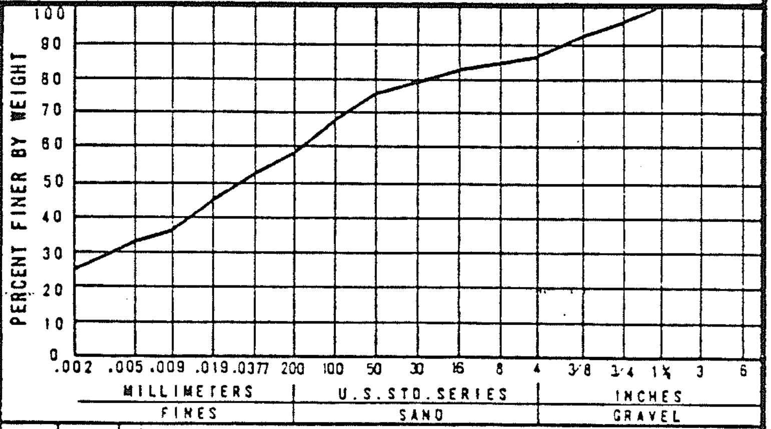








	SPECIMEN NO.			
INITIAL CONDITION	Water Content, %	20.5		
	Opt. Water Content, %	---		
	Dry Density, pcf	108.0		
	Max. Dry Density, pcf	---		
	Void Ratio	0.572		
	Saturation, %	97.7		
FINAL CONDITION	Confin. Pressure, psi	50.0		
	"B" Parameter	0.30		
	Volume Change Prior to Shear, %	1.3		
	Void Ratio	---		
	Saturation, %	---		
GENERAL	Specimen Diameter, in.	2.875		
	Back Pressure, psi	0		
	Time Test, hr.	1.73		
	Rate of Strain, %/hr.	7.69		



SYMB	CL	SOIL CLASSIFICATION: BROWN, GRAVELLY, SANDY CLAY
LL	42	
PL	21	SAMPLE LOCATION: HOLE AD-1, PB-8, 95-97.5 FEET
PI	21	
SG	2.72	NOTE:

834(REV)

W. A. WAHLER & ASSOCIATES

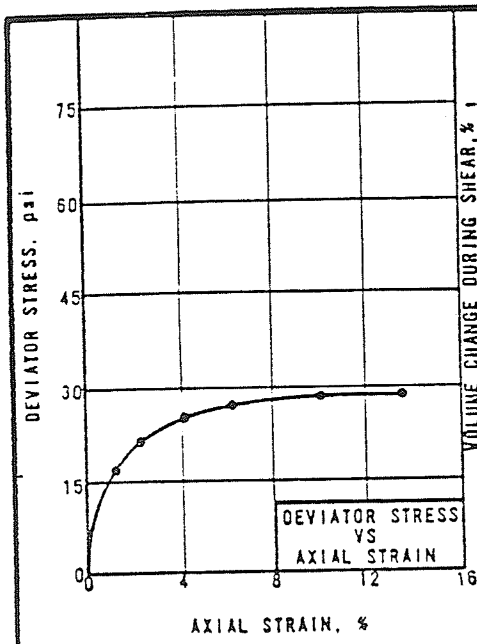
PALO ALTO · NEWPORT BEACH · CALIF.

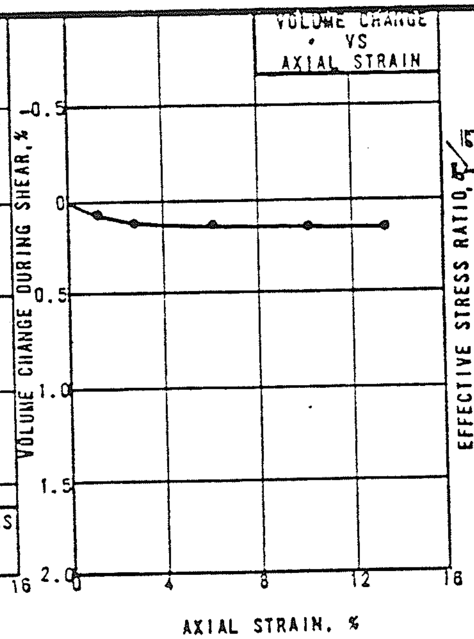
ANDERSON DAM

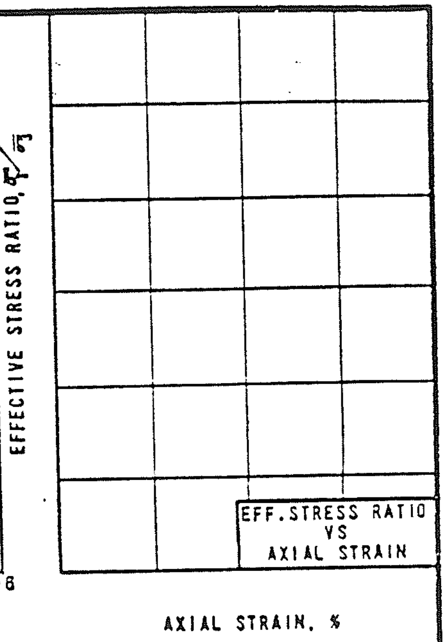
UNCONSOLIDATED UNDRAINED
TRIAXIAL TEST RESULTS

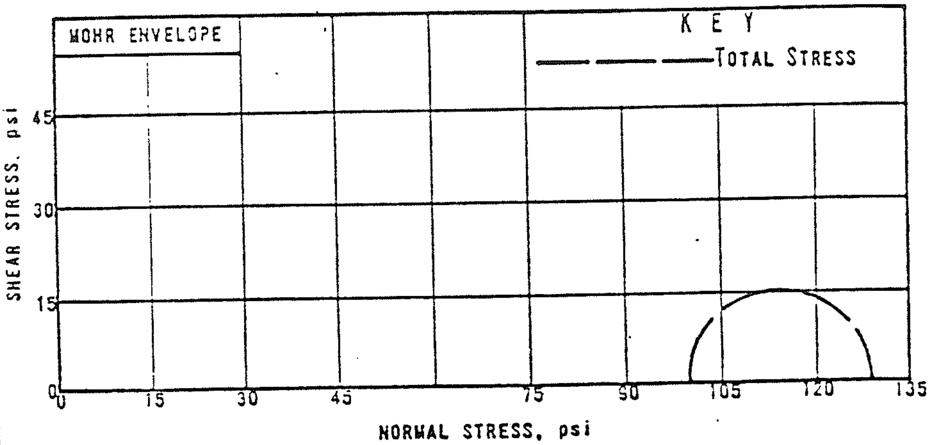
PROJECT NO.	DATE	SHEET NO.
0746A	DECEMBER 1975	FIGURE B-3

SAMPLE NO.
AD-1, PB-8

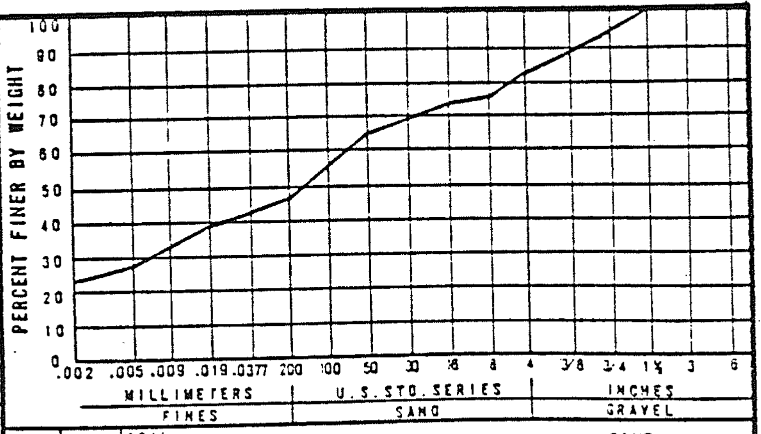








	SPECIMEN NO.			
INITIAL CONDITION	Water Content, %	19.3		
	Opt. Water Content, %	---		
	Dry Density, pcf	110.7		
	Max. Dry Density, pcf	---		
	Void Ratio	0.522		
	Saturation, %	'00.0		
FINAL CONDITION	Confin. Pressure, psi	100.0		
	"B" Parameter	0.74		
	Volume Change Prior to Shear, %	3.9		
	Void Ratio	---		
	Saturation, %	---		
GENERAL	Specimen Diameter, in.	2.875		
	Back Pressure, psi	0		
	Time Test, hr.	1.72		
	Rate of Strain, %/hr.	7.75		

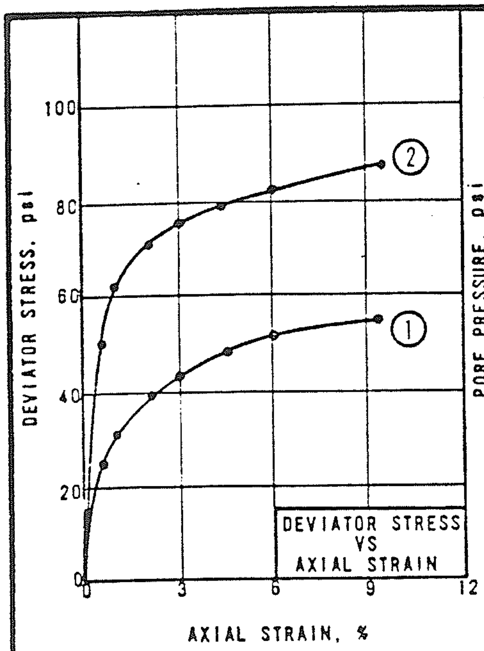


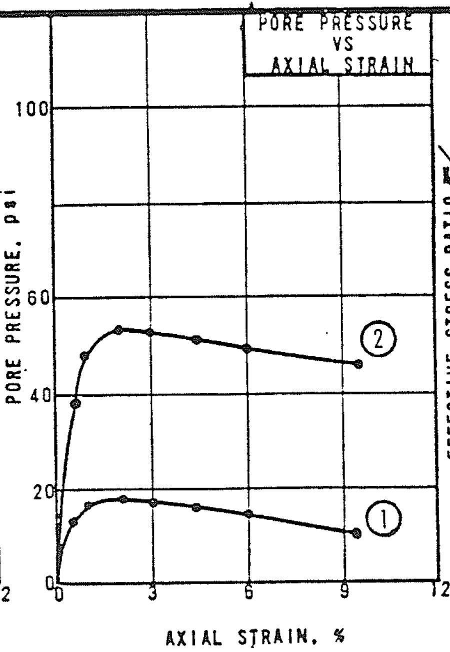
SYMB	SC	SOIL CLASSIFICATION: BROWN, GRAVELLEY, CLAYEY SAND
LL	36	
PL	18	SAMPLE LOCATION: HOLE AD-1, P8-14, 200-202.5 FEET
PI	20	
SG	2.7	N O T E:
	EST)	

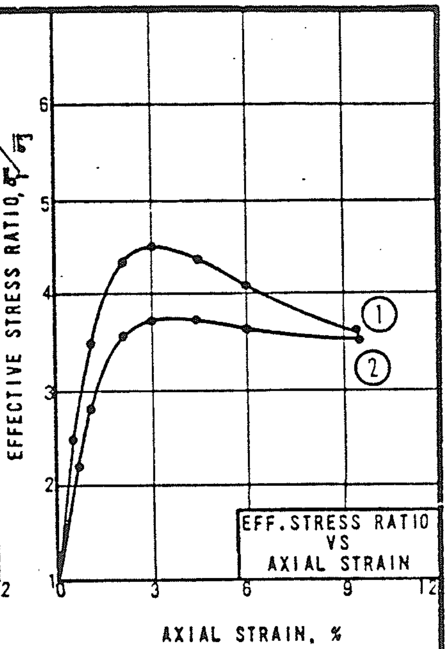
W. A. WAHLER & ASSOCIATES	ANDERSON DAM	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			SAMPLE NO.
		PROJECT NO.	DATE	SHEET NO.	AD-1, P8-14
	PALO ALTO · NEWPORT BEACH · CAL'F	0746A	DECEMBER 1975	FIGURE 8-3	

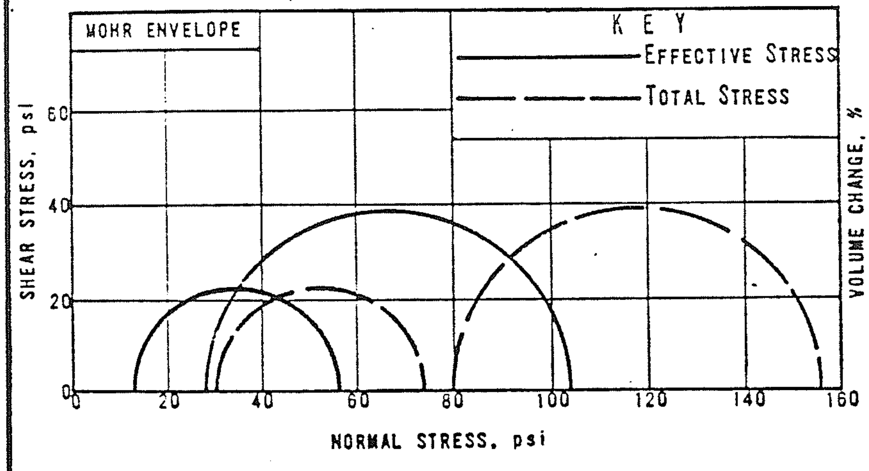
834(REV)

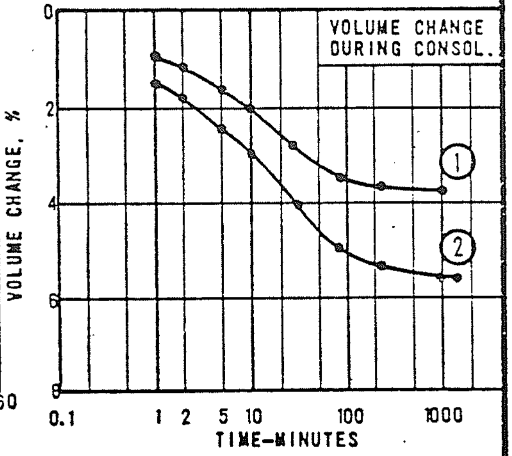
Sheet 4 of 7



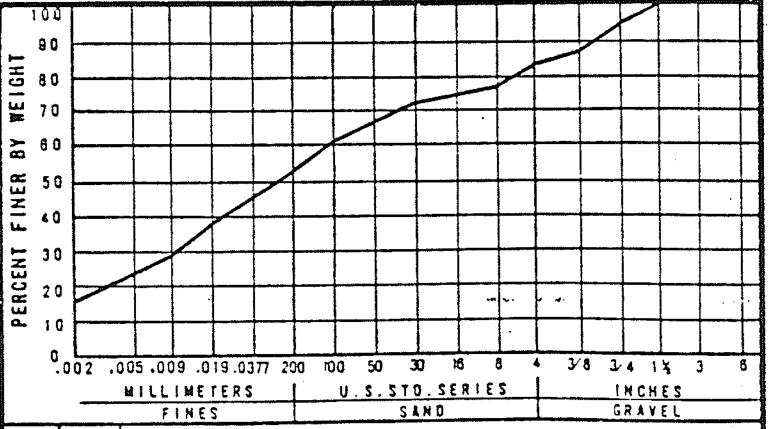








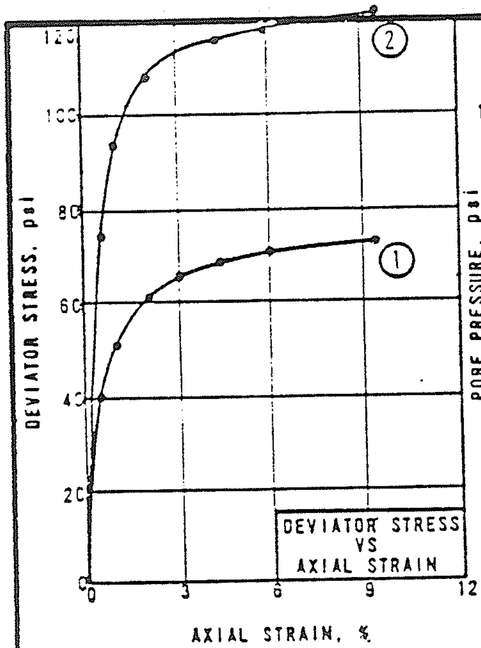
	SPECIMEN NO.	①	②	
INITIAL CONDITION	Water Content, %	20.1	20.0	
	Opt. Water Content, %	---	---	
	Dry Density, pcf	109.1	109.4	
	Max. Dry Density, pcf	---	---	
	Void Ratio	0.544	0.540	
	Saturation, %	100.0	100.0	
FINAL CONDITION	Consol. Pressure, psi	30.0	80.0	
	Water Content, %	18.0	16.9	
	Dry Density, pcf	113.4	115.8	
	Void Ratio	0.487	0.455	
	Saturation, %	100.0	100.0	
GENERAL	Specimen Diameter, in.	2.875	2.875	
	Back Pressure, psi	50.0	50.0	
	Test time, hr.	2.33	2.33	
	Rate of Strain, %/hr.	4.00	4.04	

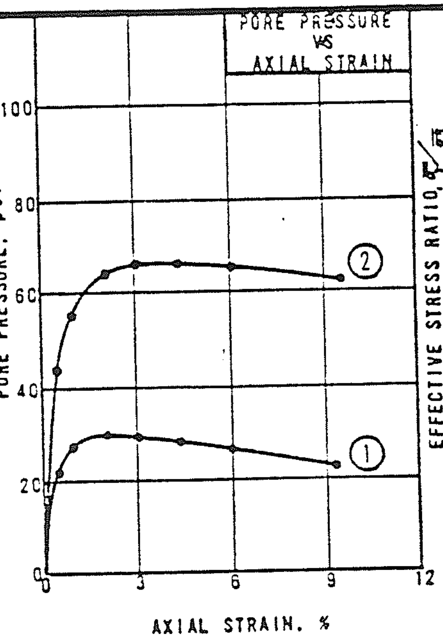


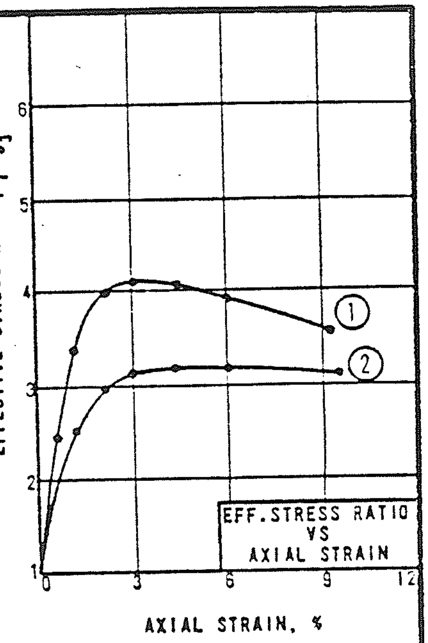
SYMB	CL	SOIL CLASSIFICATION: BROWN, GRAVELLY, SANDY CLAY
LL	37	
PL	21	SAMPLE LOCATION: Hole AD-1, PB-4, 55-57.5 feet
PI	16	
SG	2.7	NOTE:
	(EST)	

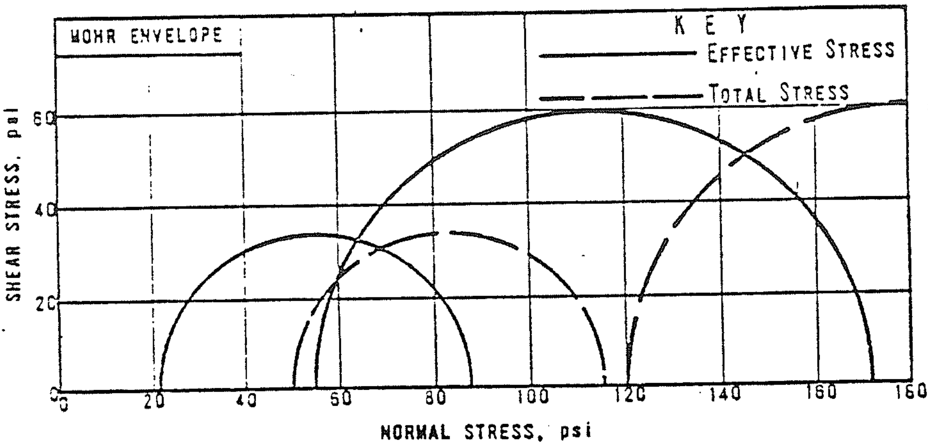
034(REV)

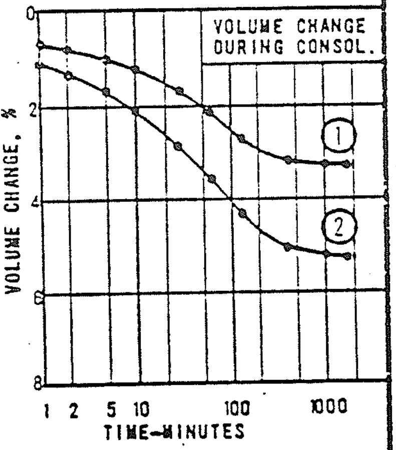
W. A. WAHLER & ASSOCIATES	ANDERSON DAM	CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS		SAMPLE NO.
		PROJECT NO.	DATE	SHEET NO.
PALO ALTO · NEWPORT BEACH · CALIF.		0746A	DECEMBER 1975	FIGURE B-3	AD-1, PB-4



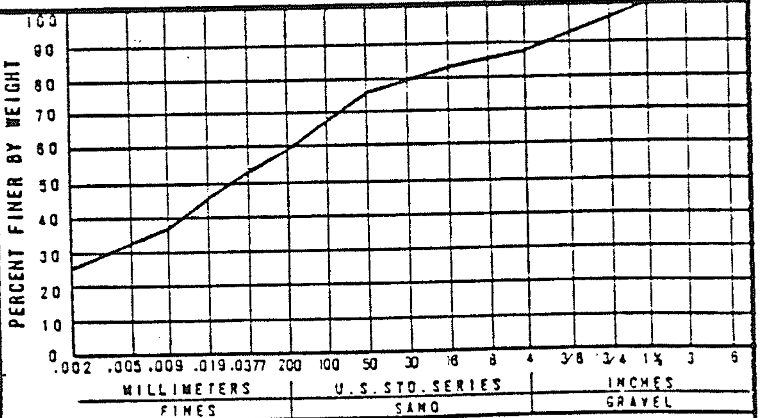








SPECIMEN NO.		①	②	
INITIAL CONDITION	Water Content, %	20.3	20.3	
	Opt. Water Content, %	---	---	
	Dry Density, pcf	108.4	109.1	
	Max. Dry Density, pcf	---	---	
	Void Ratio	0.567	0.556	
	Saturation, %	97.8	99.2	
FINAL CONDITION	Consol. Pressure, psi	50.0	120.0	
	Water Content, %	18.9	17.4	
	Dry Density, pcf	112.0	115.2	
	Void Ratio	0.515	0.474	
	Saturation, %	100.0	100.0	
GENERAL	Specimen Diameter, in.	2.875	2.875	
	Back Pressure psi	50.0	50.0	
	Time Test, hr.	2.33	2.33	
	Rate of Strain %/hr	3.99	4.04	



SYMB	CL	SOIL CLASSIFICATION: BROWN, GRAVELLY, SANDY CLAY
LL	42	
PL	21	SAMPLE LOCATION: HOLE AD-1, PB-8, 95-97.5 FEET
PI	21	
SG	2.72	NOTE: SPEC. #1 DID NOT HAVE FILTER STRIPS

034(REV)

W. A. WAHLER
& ASSOCIATES

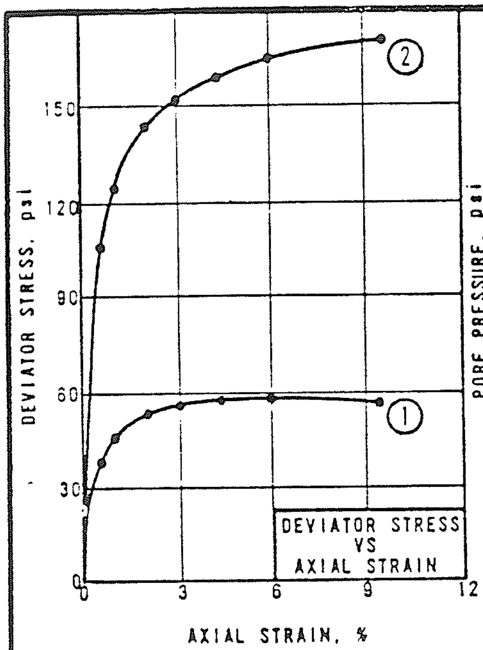
PALO ALTO · NEWPORT BEACH · CALIF.

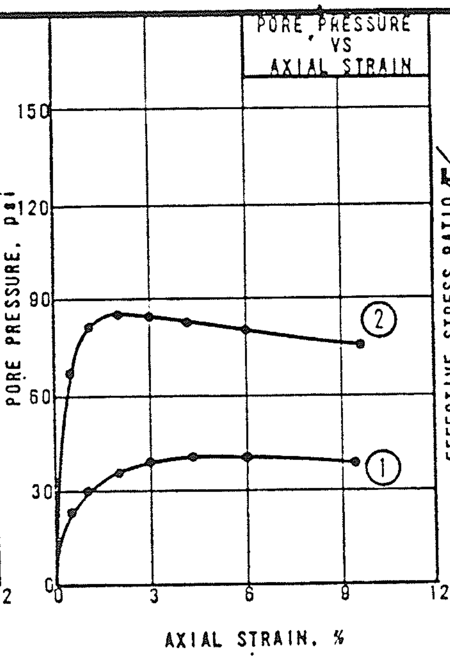
ANDERSON DAM

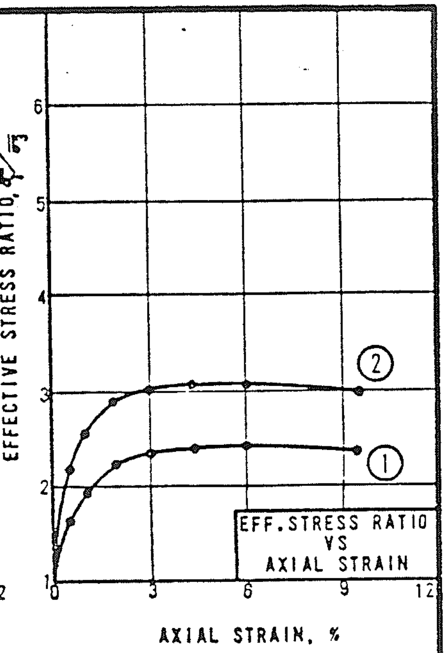
CONSOLIDATED UNDRAINED
TRIAXIAL TEST RESULTS

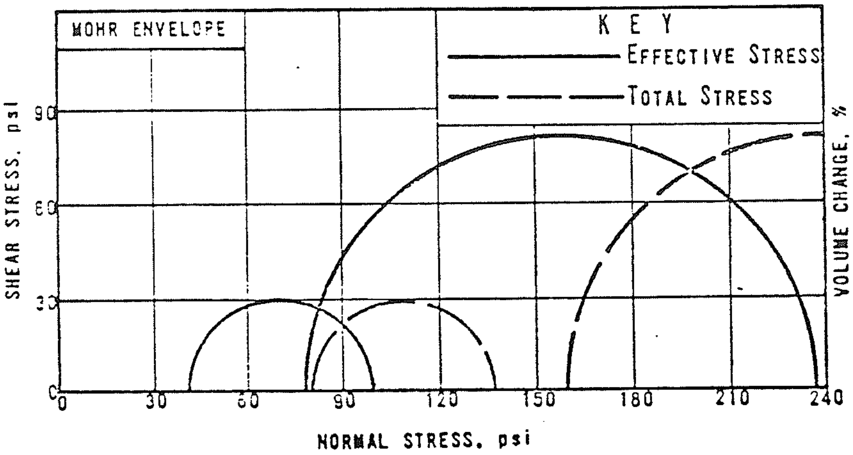
PROJECT NO.	DATE	SHEET NO.
0746A	DECEMBER 1975	FIGURE 8-3

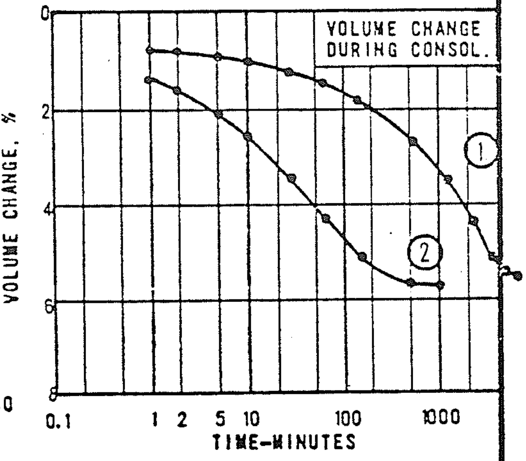
SAMPLE NO.
AD-1, PB-8



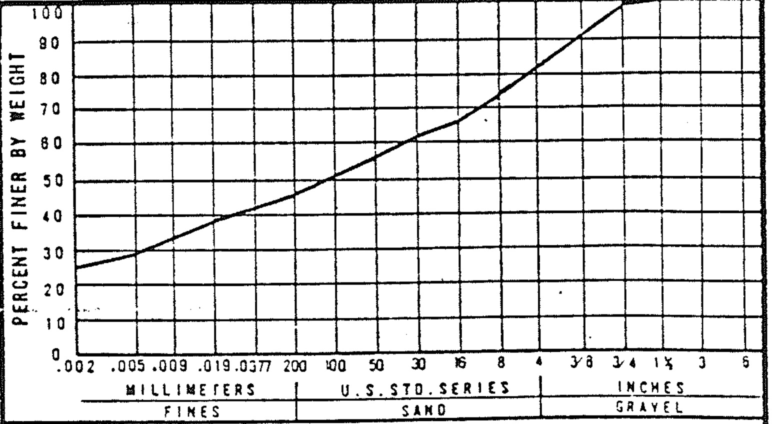








SPECIMEN NO.		①	②
INITIAL CONDITION	Water Content, %	19.8	17.3
	Opt. Water Content, %	---	---
	Dry Density, pcf	110.8	114.4
	Max. Dry Density, pcf	---	---
	Void Ratio	0.543	0.496
	Saturation, %	100.0	96.1
FINAL CONDITION	Consol. Pressure, psi	80.0	160.0
	Water Content, %	16.8	15.0
	Dry Density, pcf	117.2	121.3
	Void Ratio	0.459	0.410
	Saturation, %	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875
	Back Pressure psi	50.0	50.0
	Test Time, hr.	4.73	2.35
	Rate of Strain, %/hr.	1.99	4.02



SYMB	SC	SOIL CLASSIFICATION: BROWN, GRAVELLY, CLAYEY SAND
LL	49	
PL	22	SAMPLE LOCATION: HOLE AD-1, PB-12, 158-160.5 FEET
PI	27	NOTE: SPEC. #1 DID NOT HAVE FILTER STRIPS DURING
SG	2.74	CONSOLIDATION BUT STRIPS WERE
		APPLIED FOR SAMPLE FAILURE.

834(REV)

W. A. WAHLER & ASSOCIATES

PALO ALTO · NEWPORT BEACH · CALIF.

ANDERSON DAM

CONSOLIDATED UNDRAINED
TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0746A	DECEMBER 1975	FIGURE B-3

SAMPLE NO.
AD-1, PB-12

APPENDIX E

Memorandum of Geologic Review

Leroy Anderson Dam
No. 72-9
November 13, 1979
by
Guy L. Hanegan

Memorandum of Geologic Review

Leroy Anderson Dam, No. 72-9

November 13, 1979

by Guy L. Hanegan

Subsequent to our meeting of April 25, 1979, with Santa Clara Valley Water District (SCVWD), they sent us References 1, 2, and 9. They also sent a Bibliography of Geologic reports in the dam area and a copy of the Construction log of the trench for the outlet pipe. This information was requested by us to help with our evaluation of the Coyote Creek fault and its possible affect on the dam embankment and outlet works.

The Coyote Creek fault has been judged inactive, but possibly capable of sympathetic movement, based on current information. (See attached memorandum entitled "Seismic Evaluation of the Coyote Creek Fault, Santa Clara County", November 13, 1979, by Guy L. Hanegan).

The construction log of the outlet trench is very difficult to match to the as-built profile. The trench stationing and the location of the outlet structures have both been changed since the trench was logged, according to SCVWD personnel. Two field note books which would accurately relate these changes to the trench log are reported to be missing. My correlation indicates that the outlet was probably moved about 30 feet downstream after the trench was logged.

Construction photographs of the outlet trench generally match the rock types shown at comparable stations on the trench log. Faults postulated in the dam foundation which are shown in Ref. 6, 7 and 10 generally match faulted areas shown on the trench log.

The only real discrepancy is the foundation of the intake tower. The log shows "soft wet black shale", but John Clarke, SCVWD employee who worked on the construction of the dam, stated that the intake foundation is "hard green sandstone". This cannot be reconciled.

The Coyote Creek fault has been judged inactive, however, there is still the possibility of sympathetic offset from the maximum credible earthquake (MCE) on the Calaveras fault. The Calaveras fault is 1.5 km easterly from the dam, and the Coyote Creek fault branches from it either 5 km (Ref. 10) or 12 km (Dibblee, 1973) southeasterly.

Five fault traces have been mapped by Wagner (Ref. 10) in the vicinity of the dam embankment. One trace of the Coyote Creek fault runs upstream of the dam and one runs under the embankment. One of the related faults runs under the embankment, one crosses the outlet works at the downstream toe, and one passes downstream of the dam embankment. A total of 9-inches to one foot of sympathetic movement is suggested. This could occur on a single trace of the fault or it could be spread over all traces. The latter seems most probable. If sympathetic movement were to occur, we estimate that offset on a single fault strand would be from 2-inches to 6-inches.

Mapping by J.B. Scott (SCVWD) indicates that the large landslide on the left abutment has been cut by branches of the Coyote Creek fault. One of our initial concerns was that landslide movement could block the intake to the outlet works. Wagner (Ref. 10) and Dibblee (Ref. 6) both show that the Coyote Creek fault does not cut these landslides. They both show a much smaller slide area than does Scott. It is hard to conceive that a fault zone could be as well preserved in a landslide mass as I have observed, and I agree with the interpretations of Wagner and Dibblee.

Photos of the reservoir bottom drained after 10 years service, do not show any evidence of slope instability near the intake. The 1962 landslide on the left abutment is at least 100 feet above the intake structure. The absence of sliding in the reservoir, shown on the aerial photos, coupled with a decrease in the landslide mass as interpreted by Wagner and Dibblee essentially eliminate the possibility of the intake structure being plugged by landslide debris.

GLHanegan:bad
11/27/79

References

1. Aerial Photographs, November 16, 1960, scale 1" = 1,000', and enlargement of area near the dam to 1" = 200'.
2. Aerial Photographs, February 18, 1973, scale 1" = 500', reservoir partially fill.
3. Brown, R. D. Jr., and Lee, W. H. K., 1971, Active Faults and Preliminary Epicenters (1969-1970) in southern part of the San Francisco Bay Region, U. S. Geological Survey, Miscellaneous Field Studies Map MF-307 (Basic Data Contribution 30).
4. Crystal Strain and Fault movement Investigation, 1964, California Department of Water Resources, Bulletin No. 116-2.
5. Dibblee, Thomas W. Jr., 1973, Preliminary Geology of the Mt. Sizer Quadrangle, Santa Clara Co., California, U.S. Geological Survey, Open File Map.
6. Dibblee, Thomas W. Jr., 1973, Preliminary Geology of the Morgan Hill Quadrangle, Santa Clara Co., California, U.S. Geological Survey, Open File Map.
7. Marliave, Chester, 1949, Geological Report on Anderson Dam site located across Coyote Creek in Santa Clara County, California Division of Safety of Dams files.
8. Rogers, Thomas H. and Williams John W., 1974, Potential Seismic Hazards in Santa Clara County, California, California Division of Mines and Geology, Special Report 107.
9. Supplementary Geologic Investigation, Rancho San Jose, San Jose, California, 1975, for Oceanic California, Inc, by Woodward-Lundgren Associates, Consulting Engineers and Geologists.
10. Wagner, David L., 1978, Diablo Range Study Area II, Southern Santa Clara County, California, California Division of Mines and Geology, Open File Report OFR78-12-SF.

APPENDIX F

Seismic Evaluation of the Coyote Creek Fault

Santa Clara County
November 13, 1979
by
Guy L. Hanegan

Seismic Evaluation of the Coyote Creek Fault

Santa Clara County

November 13, 1979

by Guy L. Hanegan

The Coyote Creek fault branches from the Calaveras fault either 5 km (Ref. 10) of 12 km (Ref. 8) southeast of Leroy Anderson Dam. Five traces of the Coyote Creek and related faults run under or adjacent to the dam embankment. The northern limit of the fault is about 12 km from the dam. Dibblee (Ref. 6) and Rogers and Williams (Ref. 7) show the fault dieing out in serpentines. If the fault were to continue through the serpentines and Franciscan Charts, it probably would be truncated at the edge of the alluvial valley fill by the Piercy fault, 4 km farther northerwest. (Ref. 7).

The Coyote Creek fault is an oblique slip fault which dips from 40 degrees to 65 degrees easterly. The movement is reversed, right-lateral, with the east side having moved upward relative to the west side.

The fault varies from a distinct, narrow contact between different rock types to a zone 130 feet wide (Ref. 9). The fault zone, which includes the Coyote Creek and several related faults, is 1,500 feet wide at the dam.

Brown and Lee (Ref. 3) show a few microquake epicenters that plot near the surface trace of the northerly end of the Coyote Creek fault. The authors suggest without explanation, however, that the Silver Creek fault, a mile or two easterly, may be their source. If this is correct, there is no detectable strain release occurring on the Coyote Creek fault.

Wagner (Ref. 10) mapped the Coyote Creek fault from about 1,600 meters north of Leroy Anderson Dam in a southerly direction to its confluence with the Calaveras fault. Within the mapped area the youngest formation offset by the Coyote Creek fault is the Plio-Pleistocene Santa Clara formation. This fault has not disturbed Holocene deposits. A related fault, which has been projected downstream from the toe of the dam embankment, has offset Holocene deposits about 6 miles south easterly from the dam.

Woodward-Lundgren (Ref. 9) placed a number of trenches across the Coyote Creek fault for a subdivision about 2 miles northwest of Leroy Anderson Dam. Santa Clara formation and older formations have been displaced in these trenches, but soils overlying the Coyote Creek fault were never faulted in any of the trenches.

The oldest radio-carbon date of any of these undisturbed soils was

2030 ± 410 years B.P.

Woodward-Lundgren (Ref. 9) also stated that they could not identify any geomorphic features along the fault on aerial photos. My search of aerial photos in the vicinity of Leroy Anderson Dam showed that the fault is very difficult to locate in this way. Most fault related geomorphic features have been subdued by erosion.

A well developed sag feature south of Leroy Anderson Dam contains Holocene deposits which have not been displaced by the Coyote Creek fault.

Conclusion

Unequivocal evidence for microquake activity on the Coyote Creek fault is lacking. The youngest formation offset by the fault is Plio-Pleistocene. It does not displace Holocene deposits. The fault is inactive.

Holocene displacement in the area mapped by Wagner (Ref. 10) is on other faults related to the Calaveras fault system.

Sympathetic Displacement

The Coyote Creek fault is about 1.5 km westerly from the Calaveras fault at Leroy Anderson dam and branches from it between 5 and 12 km distant. This relationship suggests that sympathetic movement on the Coyote Creek fault might result from the maximum credible earthquake (MCE) on the Calaveras fault. The Silver Creek fault lies about midway between them at Leroy Anderson Dam and branches from the Calaveras fault nearby. The Silver Creek fault may act as a buffer to absorb a share of the possible sympathetic offset resulting from the MCE on the Calaveras fault. The predominantly reversed displacement and resulting sinuous trace of the Coyote Creek fault would also tend to reduce the impact of right lateral sympathetic offset.

Wagner (Ref. 10) has mapped 5 traces of the Coyote Creek and related faults near the dam. Emperical data (Bonilla, 1967) indicates that 1½ to 2 feet of sympathetic movement on the Coyote Creek fault could possibly result from the MCE on the Calaveras fault. Assuming that one-half of this would be absorbed by the Silver Creek fault, offsets from 9 inches to one foot could be possible on the Coyote Creek fault. This might occur on a single branch of the fault, but it would more likely by distributed over several branches. Because of the general rock condition in the dam foundation and other factors stated herein we suggest that the potential offset on a single fault strand could be from 2 inches to 6 inches.

GLHanegan:bad
11/17/79

References

1. Aerial Photographs, November 16, 1960, scale 1" = 1,000', and enlargement of area near the dam to 1" = 200'.

2. Aerial Photographs, February 18, 1973, scale 1" = 500', reservoir partially full.

3. Brown, R.D. Jr, and Lee, W.H.K., 1971, Active Faults and Preliminary Epicenters (1969-1970) in Southern part of the San Francisco Bay Region, U.S. Geological Survey, Miscellaneous Field Studies Map MF-307 (Basic Data Contribution 30).

4. Crystal Strain and Fault Movement Investigation, 1964, California Department of Water Resources, Bulletin No. 116-2.

5. Dibblee, Thomas W. Jr., 1973, Preliminary Geology of the Mt. Sizer Quadrangle, Santa Clara Co., California, U.S. Geological Survey, Open File Map.

6. Dibblee, Thomas W. Jr., 1973, Preliminary Geology of the Morgan Hill Quadrangle, Santa Clara Co., California, U.S. Geological Survey, Open File Map.

7. Rogers, Thomas H. and Williams John W., 1974, Potential Seismic Hazards in Santa Clara County, California, California, Division of Mines and Geology, Special Report 107.

8. Dibblee, Thomas W. Jr., 1973, Preliminary Geology of the Gilroy Quadrangle, Santa Clara Co., California, U.S. Geological Survey, Open File Map.

9. Supplememtary Geologic Investigation, Rancho San Jose, San Jose, California, 1975, for Oceanic California, Inc., by Woodward-Lundgren Associates, Consulting Engineers and Geologists.

10. Wagner, David L., 1978, Diablo Range Study Area II, Southern Santa Clara County, California, California Division of Mines and Geology, Open File Report OFR78-12-SF.

APPENDIX G

DSOD Evaluation of Dam Stability Under Static and Seismic Loading

Memorandum of Design Review

Leroy Anderson Dam, No. 72-9

Static Stability

May 22, 1979

By D. Smith - D. Babbitt

Reference

Wahler, W. A., and Associates, "Anderson Dam - Evaluation of Stability and Performance", April 1977.

Description

Dean Smith, in reviewing the reference during 1977, checked the static stability. His review was included in a draft report on the seismic stability. John Vrymoed has recently completed the seismic review and is reporting it separately. This memo reports Dean's work.

The work performed by the consulting engineer included: (1) one 5-inch rotary drill hole from crest to bedrock, (2) installation of two pneumatic piezometers, (3) one bulldozer and two backhoe trenches in the upstream and downstream slopes, (4) laboratory testing of undisturbed samples and (5) conventional stability analysis by Bishop's modified method.

The laboratory tests were performed on undisturbed 2.875-inch-diameter, thin wall tube samples of impervious material. These tests were conducted following established procedures in accordance with current practices, usually ASTM. Triaxial shear tests were conducted under unconsolidated-undrained and consolidated-undrained conditions. Strength parameters for the impervious material were determined from the effective stress paths during the CU tests. The failure criterion for the CU tests was the point of maximum principle effective stress. The consultant's soil test results include the following:

In-situ dry density	110.5 pcf
Water content	19.5 %
Saturation	98 %
Effective friction angle	28°
Cohesion	6.2 psi
Liquid limit	42 %
Plasticity index	22 %
Permeability	2.5×10^{-8} cm/sec

The gravelly cobbley nature of the pervious material made sampling and testing impractical. The consultant based his estimation of

Babbitt 5/22

the shear strength of the pervious material on triaxial shear tests conducted at UC Berkeley. The test specimens consisted of gravelly soils with a maximum particle size of up to 2 inches. The consultant conducted two sets of stability analyses based on the minimum and the average values of the above tests. These values are:

	Minimum	Average
Effective friction angle	35°	40°
Cohesion	250 psf	230 psf

Only the stability analyses based on the minimum values are discussed below. The author used the strength parameters determined by the consultant except for assigning a value of zero to the cohesion of the pervious material.

The static stability analyses performed by the consultant and verified by the author indicate that the embankment satisfies the Division's criteria for static loading conditions, Table 1.

Table 1

Safety Factor by Bishop's Modified Method

Downstream Slope	Consultant	Author	Division Criteria
1. Steady-state seepage, static loading	1.95	1.9	1.5
2. Steady-state seepage, pseudostatic-0.1g	1.5	---	1.1
3. Steady-state seepage, pseudostatic-0.2g	1.2	---	N/A
Upstream Slope			
4. Steady-state seepage, static loading	2.1	1.8	1.5
5. Rapid drawdown, static loading	1.8	1.6	1.25
6. Steady-state seepage, pseudostatic-0.1g	1.4	---	1.1
7. Steady-state seepage, pseudostatic-0.2g	0.95	---	N/A

Conclusion

The consultant has adequately demonstrated that the embankment satisfied Division criteria for failure along a circular failure plane for static loading and both rapid drawdown and steady-state seepage conditions.

DSmith/DBabbitt:drs
5/22 79

Memorandum of Design Review

Leroy Anderson Dam, No. 72-9

May 29, 1979

by J. L. Vrymoed MAY 31 '79 JLV

References

1. Memorandum of Geologic Review, Left Abutment Landslides, April 4, 1978, by G. L. Hanegan.
2. Left Abutment Landslides, April 1977, by SCVWD, J. B. Scott.
3. Evaluation of Stability and Performance, April 1977, by W. A. Wahler and Associates, (WAWA).
4. Memorandum of Design Review, May 22, 1978, by D. Smith and D. Babbitt.
5. Memorandum of Geologic Review, April 13, 1978, by G. Hanegan.

This memorandum summarizes an evaluation made of the dynamic stability of the dam and the effect of the left abutment landslides on the operation of the outlet.

Having read the report by WAWA (Reference 3), I concur with the report's conclusion that the dam is stable for the maximum credible earthquake postulated. It is for the following reasons that I concur with the report's conclusion.

Shell Zones

The upstream and downstream shell zones consist mainly of rockfill materials obtained from nearby quarries at the time of construction. WAWA in their field investigations found particle sizes ranging up to 42 inches in diameter. By viewing the materials exposed in the trenches it is difficult to envisage this rockfill material retaining any pore pressure. Any tendency for pore pressure build-up due to consolidation of the rock mass would be almost immediately relieved because of the high permeability of the rockfill materials.

It is not suggested that the rockfill is clean. After the material had been delivered to the fill the fines were washed through the rockfill with a high pressure water hose. This resulted in layering of the rockfill with the finer particle sizes settling at the bottom of the layer. This them produced a layering effect of clean and dirty rockfill. Rock-to-rock contact still predominates, however, with the larger voids on the order of inches in the cleaner portions of the layer. This provides for many flow paths allowing any pore pressure build-up to be quickly relieved. The predominant flow path will probably be in a horizontal direction towards the reservoir.

There will undoubtedly be settlement of the rockfill zones during earthquake loading. It is difficult to estimate how much settlement, as evidence of actual behavior of a rockfill dam during an earthquake is practically nonexistant. I would speculate, however, that the performance of a rockfill dam during an earthquake would be much better than the performance of a sandy, silty embankment.

Since construction the dam has settled 1.4 percent of its maximum height. The present amount of freeboard will allow for almost 4½ times this amount of settlement. WAWA speculates the settlement to be on the order of 1 to 3 feet.

Core Zone

Failure or any movement of the core zone is restricted and thereby excluded due to the existence of the rockfill shell zones. For movement of the core zone to take place, a force would have to be generated sufficient to cause failure in the core zone (circular arc type) and then exert a passive pressure on the rockfill. Since this is hard to conceive, the core zone will not settle more than the rockfill zones and probably a lot less. The tendency for settlement of the core is restricted due to the dense clayey nature of the material. Actually, the rockfill as it settles will drag and tend to consolidate the clay core zone. This would not, however, be true for the entire core zone but only for two to three feet in the core zone at the shell contact. Pore pressures will be generated in the core zone and will dissipate very slowly due to the very low permeability of the core. In conjunction with dissipation of these pore pressures, there will be settlement of the core over an extended period of time. The amount of settlement of the core zone should be much less than that of the rockfill.

Coyote Creek Fault

Possible offset on the Coyote Creek fault and its effect on the dam's stability was not addressed by WAWA. This fault, as presently mapped, runs parallel to the crest, crosses the spillway, the upstream shell and very possibly the outlet. Offset on this fault will most likely cause considerable damage to the spillway and outlet. The overall integrity and stability of the dam, however, will not be impaired. Reference 5 indicates a compressional component of displacement whereby the material on the upstream side of the fault is thrust over the material downstream of the fault. Since the offset does not traverse the shell and the core and is a compressional offset, possibilities for a piping failure are very remote.

The alignment of the fault is located by evidence of offsets on both abutments. From this evidence, the fault appears to cross the outlet. Whether it actually crosses the fault is not significant. Should the fault pass the outlet some distance upstream there is no guarantee that future offsets will occur along the same fault line. Hence, accurate location of the fault, should it not intersect the outlet, would not guarantee an operable outlet after seismic activity.

Outlet Capacity

The outlet is a 49 1/8-inch-diameter pipe encased in concrete. Both the inlet and outlet have valving. Computation made assuming reservoir storage at spillway level showed the max Q to be 626 cfs. When this was reduced by 20 percent to allow for losses due to valving, the resulting Q was the same as that reported in the file, 500 cfs. This outlet capacity translates into reducing the reservoir level at the rate of .6 to .7 ft/day. This drawdown rate is too low for the outlet to have a major beneficial effect during an emergency. At this rate it would take 23 days to double the existing 15 feet of freeboard assuming no inflow.

During the last 13 years, the reservoir level has been within 15 feet below spillway level for 22 percent of the time. During that same period the average amount of freeboard has been 65 feet.

Landslides - Left Abutment

The presence of landslides on the left abutment was known at the time of construction. What was apparently not known was the presence of a fault intersecting a portion of the upstream shell and intersecting the outlet pipe very near the inlet structure. The outlet is thus threatened by offset on this fault and by the landslide taking out the intake structure.

A stability analysis of the landslide would most likely be an exercise in futility. I am not aware of any analysis which would, with some degree of certainty, indicate the behavior of this slide under maximum credible earthquake loading of 0.7g. The only worthwhile effort that could be made would be to see if the large landslide has come to rest. This would require emptying the reservoir, which could take 6 months, again assuming no inflow.

All of these adverse conditions are mitigated by the conclusion that the dam will survive the maximum credible earthquake with only a minor amount of loss in freeboard. The possibility of the outlet being inoperable due to earthquake loading is unsettling however. There is little that can be done to mitigate these adverse circumstances.

I think it would be entirely reasonable for the Division to ask the District what means they would employ to substantially increase the freeboard should the outlet become inoperable. I am aware that the District has mentioned the dredging of any material blocking the outlet. This would not restore drawdown capacity, however, should the outlet pipe become severed due to offset on the Coyote Creek fault.

Summary

1. The outlet capacity is inadequate to have a major beneficial effect during emergency conditions.
2. Drawdown capability cannot be counted on after MCE loading due to:
    a. Possible offset on the Coyote Creek fault.
    b. The large landslide "C", although appearing stable at this time, could be activated due to large acceleration levels.
3. These adverse conditions with respect to drawdown capability are mitigated by:
    a. The 15 feet of freeboard.
    b. The good overall dynamic stability of the embankment proper.
    c. The average operating freeboard of 65 feet.
4. Offset on the Coyote Creek fault does not pose a threat to the dam.

Recommendations

Request the District to formulate and submit for approval a plan to drawdown the reservoir assuming the outlet to be inoperable.

JLVrymoed:dkc
5/31/79